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Co-operation for Business Expansion

Companies normally competitive have learned from experience that they can well afford to co-operate in many ways for the good of their particular line of business as a whole while maintaining sharp competition for individual shares of that business. Non-competitive companies engaged in the same line of business, such as central stations in different communities, have accomplished many excellent results by co-operation along innumerable lines. Co-operation in the expenditure of a part of the money now spent competitively or separately in increasing the electrical business of the country is the keynote of an article in this issue by Mr. J. Robert Crouse, who has preached co-operation to electrical audiences for many years. Even the most skeptical will admit that the objects to be accomplished by the Society for Electrical Development, the principles of which he sets forth strikingly, are well worth while, and that all persons asked to contribute to it will be benefited by the results. To a much greater extent than is justified by the facts, many central station managers have assumed that subscription to the society would mean merely additional expense without proportionate return therefrom. The fact is that it should involve merely the transfer of a portion of present expense to the column of co-operative expenditure. Doubtless, the amount needed to bring the pledges up to $200,000 will be subscribed, but it is appropriate at this time to urge those companies now hesitating to join in the co-operative movement to cast in their lot without delay in order that the co-operative electrical business expansion plan may quickly be given the trial it so well merits.

The Parcel Post and Electric Delivery

With the establishment of the parcel post, and now the decision to extend this service and to inaugurate reduced rates, the amount of fourth-class matter carried by the United States Post Office Department has been very greatly increased. Even the first estimate of 300,000,000 parcels now seems likely to be far exceeded, the official statements putting the probable first year's business at 600,000,000 packages. It is thus very apparent that it will soon be impracticable to deliver this enormous amount of package mail in cities by the present method of using horse-drawn wagons, or even, perhaps, by supplanting these wagons with motor vehicles. It is believed that the government is considering seriously the establishment of a greatly extended pneumatic-tube system in cities, or else some underground light railway system to be electrically operated between the central post office and branch post offices. Private concerns have already designed automatically controlled electrical railways to have a much greater carrying capacity than any pneumatic-tube system. The government is undoubtedly familiar with the experiments which have been made in this direction, and if an electrical system of this kind should be adopted it would be another demonstration of the adaptability, convenience and flexibility of electrical energy in connection with the requirements of modern life.

Convention of Electrical Contractors

The convention of the National Electrical Contractors' Association of the United States, at Chattanooga, showed that the organization is growing in wisdom as well as in strength. The chip has disappeared from its shoulder; suspicion has given place to partial confidence at least, and altogether the outlook is very promising indeed. Recognition of the necessity for maintaining a high standard of work and overcoming the abuses which exist in the wiring and contracting trade has brought with it breadth of vision and the determination to meet the obligations squarely. Time was when the contractor imagined the central station, manufacturer, jobber, inspector and dealer were all pitted against him, and he threw up breastworks for defense only to find that his foe was largely of his own imagination. It has taken a little time and persuasion for him to appreciate their rights and their points of view, and to learn that it is possible for him to promote friendly and profitable relations with them all; but the lesson has been taught and the electrical contractor has now become an ardent advocate of co-operation. This was one prominent feature of the convention at Chattanooga. A crying need was also met there in the adoption of an adequate system of bookkeeping and an accurate record for material used on jobs and job costs. The electrical contracting business has long lacked stability owing to the absence of a proper accounting system. Perhaps the most important subject brought before the convention was the proposition to guarantee wiring, and the reception with which the scheme was received augurs well for the organization. For a non-professional body the plan is equivalent to the adoption of a code of ethics, and if brought to fruition will do much to enhance the dignity of the contractors' association as a national and responsible body and to further the use of electricity. The country has long suffered from the effects of poor wiring which has hurt not only the central stations but the contractors and the industry as well. It has also destroyed the confidence of the public in electric service and has created uneasiness in the minds of many as to the safety of electricity. What is needed to offset this baneful condition of affairs is a determination on the part of the National Electrical Contractors' Association that only first-class work shall be done; and this can be brought about by

the adoption of some guaranteed wiring plan. A national standard for wiring already exists in the shape of the National Electrical Code. First-class wiremen are also plentiful. When the latter work according to the former the job is safe to guarantee. The plan is simple, straightforward and honorable. It is certainly worthy of adoption. It might even be made a slogan.

Free Tungsten Renewals

The gradual reduction in price and improvement in quality of the tungsten lamp bring forward for serious consideration by central station managers the question of supplying renewals of tungsten lamps free. As long as tungsten lamps were costly and fragile, this question was not pressing, although some able central-station managers, even in the early days of the tungsten lamp, proceeded on the theory that the central station must in some way control tungsten lamp renewals for the same reason that most of the large central stations have controlled carbon lamp renewals; namely, to prevent inferior lamps being used to the detriment of the company's service. The necessity for such control has not yet appeared in connection with tungsten lamps, as it did with carbon lamps. This is due chiefly to the fact that tungsten lamp manufacture in this country is a monopoly at present as compared to carbon lamp manufacture in the earlier days of the incandescent lamp industry. Then lamps were sold to the general public either on the ground of cheapness or long life, and in order to secure the latter salesmen usually sold lamps of low efficiency to the uninformed customer with the result that the customer had to pay bills out of all proportion to the amount of light he obtained. Now, conditions have almost reversed, and it is usually the central station man who urges customers to take tungsten lamps of such voltage as to give a long life on a given circuit while the avowed efforts of the manufacturers is in the other direction, namely to persuade central stations and consumers that lamps should be operated at high efficiency in order to secure the lowest cost of lighting, including both electrical energy and lamp renewals. Such a policy is obviously more to the interest of lamp manufacturers than the old policy of selling low-efficiency long-lived lamps, because it means more lamp renewals and greater lamp sales per year. Until such time as central station consumers attempt false economy by operating tungsten lamps at low efficiency, there appears to be no necessity for central station interference or guidance as to renewals of tungsten lamps. However, control of the tungsten lamp output to consumers has been effected by the policy adopted by some central stations of selling tungsten lamps at a cost below that at which dealers can sell them. This precludes any possibilities of tungsten lamps being purchased by consumers from other than the central station company. Such central stations just as truly control the kind of tungsten lamps used on their circuits as they do the carbon lamps on which they furnish free renewals.

Recently the question has come up whether it would not be cheaper for a central station company giving free renewals of carbon lamps to substitute tungsten lamps and operate them at a lower efficiency than now is common, so that the total cost of lamp renewals per kw-hr. would be less than for the carbon lamps. One of the objections offered to this plan is that if the tungsten lamp is operated at sufficiently low efficiency to bring its renewal cost per kw-hr. below that of the carbon lamp it would have such a very long life that the danger from accidental breakage would increase in importance, especially in view of the fact that tungsten lamps become brittle with age. It is nevertheless interesting to know that tungsten quality and price have now reached a stage where such a policy on the part of central stations can be seriously considered. Already many of the larger Edison companies have adopted the policy of furnishing tungsten lamps of 100-watt rating and over free, while at the same time offering the 60-watt and 40-watt lamps at prices far below cost.

An Iowa Central-Station System

On that future day when some electrical Homer lifts an inspired pen to write the epic of the central-station industry his scenario will not be laid in a Fisk or Waterside station or his chorus summoned from the peaceful army of employees of some great metropolitan electric-service undertaking. Broad and diverse as are the problems confronting these admirable organizations which have the serving of populations of hundreds of thousands, it is in the achievements of the far more numerous cities of medium size that the real progress of the industry must, after all, be measured. Here expertness can not be devoted to specialization but to generalization, and in his time each man must be prepared to play many parts.

Representative of best practice in those smaller systems which make up the great bulk of the industry is the central-station plant supplying service to Waterloo and Cedar Falls, Iowa, a detailed description of which is given on a following page. In the Waterloo situation special attention is called to the subservience to the modern tendency to distribute from substations instead of from the central power house as was the practice of a decade ago. The development of alternating-current motors and other apparatus is also attested in the use of alternating current for distribution purposes even in the downtown business section. Most of our older medium-sized cities, especially in the East, have been unable to free themselves from the direct-current systems of early days, and fortunate indeed are those newer communities in which modern practice is possible throughout, without respect to the trammeling inheritances of a past electrical generation. An ingenious combination of lighting and motor-supply circuits is also shown in the underground distribution scheme, which is designed to prevent pressure variations on the motor circuits from being felt on the lighting lines. Notice is also directed to the very complete record form devised for the Citizens' Gas & Electric Company which presents a detailed report of all instrument and meter readings, for units, plant and circuits, in addition to showing the periods of service of each boiler, machine and employee, and the variation in plant load.

Referring to the broader aspects of the local situation who can view even casually the rising output curves kept

during the last ten years without having his imagination fired? Beginning almost at datum, that significant slope denoting thousands of kw-hours of monthly output has struggled always upward until a maximum of 600,000 units was attained during the dark month of last October. And after a glance at this mounting progress who can predict or deny Himalayan heights to which another decade or two will carry "the thin red line" of Mr. Burt's recording wattmeter charts; for in this—history reversing itself—is the peaceful victory of the twentieth-century Waterloo!

The Sterilization of Water

The paper by Dr. Max von Recklinghausen on the use of the ultra-violet radiation from quartz-tube mercury-vapor lamps in the sterilization of water gives a strong impression that the method has passed far beyond the experimental stage into a very practical form of effective sterilization. Rays of wave-length less than 300 μμ are exceedingly effective in the destruction of bacilli, even the most resistant succumbing after a very short exposure. The quartz-tube lamp is by no means the most convenient powerful source of such radiation because the proportion of energy in the region of very short wave-lengths is exceptionally large. Even with the ordinary commercial lamp about one-half of the total ultra-violet light has a wave-length of less than 300 μμ and hence is effective for sterilizing purposes. One-half of the energy is completely cut off by the ordinary inclosing globe of such a lamp, but when the bare tube is brought close to the water to be sterilized these very rays can freely get through the quartz and penetrate filtered water remarkably well. It is interesting to note in this connection that the mercury arc gives out very little radiation having wave-lengths so short that it is stopped by the quartz tube, so that nearly all the energy of extremely short wave-length is readily utilized.

For sterilization purposes, the ordinary commercial quartz-tube mercury-vapor lamp is not sufficiently powerful to be conveniently worked on a large scale, and hence the special type of lamp described by Dr. von Recklinghausen has been developed to operate on a 500-volt circuit with about 375 volts effective at the electrodes. This lamp is operated intensively at a high temperature and gives very much greater efficiency of production of the useful rays than does the lamp ordinarily used for illuminating purposes. It is a curious fact that preliminary filtering to remove suspended matter of every kind is necessary for the effective working of the apparatus, although the ultra-violet rays penetrate filtered water with great readiness yet they are stopped very effectively by matter carried in suspension, much more readily than are ordinary light rays. Whether the effect is due to the extremely small size of many of the suspended particles which scatter the ultra-violet light, and whether it is chiefly due to organic or inorganic matter in suspension is not yet clear, but it is certain that the operation of an ordinary filter permits the necessary penetration of the ultra-violet rays to secure rapid sterilization. The beauty of the process is its absolute cleanliness, leaving the water entirely suitable for use. Various chemical agents used for water purification are, perhaps, equally effective in killing bacteria, but are not quite pleasant to have in drinking water. The plant mentioned by Dr. von Recklinghausen in which from 7500 to 8000 tons of water per day is sterilized is an admirable example of the practical application of the process. From pretty thorough tests of the process the sterilization is genuinely complete. No guilty microbe escapes after passing under the rays of the battery of lamps.

Construction Contracts

In connection with the recent contract between the city of New York and the Interborough Rapid Transit Company for the so-called dual subway system, there is a provision for third-tracking and extending the elevated systems, upon which it is estimated some $25,000,000 will be expended. The company now proposes to award the contract for the work, without competitive bidding, to a former chief engineer of the Panama Canal, on the basis of cost plus a percentage profit. This proposal, as pointed out by Borough President McAneny, is improper in several respects, two of the chief points being that such an arrangement places a direct premium upon waste and extravagance and that the contractor is directly relieved of financial responsibility in the matter. A further objection lay in the fact that the proposed contract was in blanket form and the actual percentage of profit was left to be determined later, at the pleasure of the contracting parties.

Quite aside from the obvious impropriety of letting such a large piece of work, in which the city is strongly interested, without competitive bidding, there is raised an interesting question as to construction contracts in general. It was once the general custom, and still prevails, to award contracts to the lowest responsible bidder for a lump sum, making him fully responsible for his own profit. A decade or more ago a certain much-advertised contractor gave considerable publicity to his plan of cost plus a profit, arguing among other things that in the end it insured the best job for the lowest price. The plan has admitted advantages, if the profit is a stipulated flat sum, instead of a percentage of the total cost. Nevertheless it is open to the objection that there is no direct incentive to economy, and the owner, unless he has very competent disinterested advice, may become the victim of an unscrupulous contractor.

It seems obviously feasible, however, to draw a form of contract based primarily on cost plus a profit which shall have the desirable safeguards and incentives for economy. For example, let the bids be prepared in the form of an estimate of maximum cost, based on the specifications, plus a provisional lump-sum profit, subject to a percentage bonus profit on savings in cost under the estimate and a corresponding penalty for excess of cost over the estimate, with the owner's maximum outlay limited in any case to the estimated cost plus the provisional lump-sum profit. In order to insure bona-fide bids under such a plan, the basis of letting the contract would be the estimated cost plus the provisional or base profit. This scheme has the great advantage of placing a premium on economy and a penalty on extravagance, besides disclosing in detail the bare cost of the work in labor and materials.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Canadian Water-Power Commission

A water-power commission, to be known as the St. Lawrence and Great Lakes Commission, is to be appointed by the Canadian government for the purpose of studying the whole field of water-power development from the head of the lakes at Montreal. It is expected that the commissioners will be Messrs. Prof. McLeod, of McGill University; Arthur Seymour, of Montreal, and C. R. Coutlee, of the engineering staff of the Department of Public Works. The intention to appoint a commission to deal with water-power questions in the Montreal district was expressed prior to the change of government in connection with the settlement of certain questions at issue among the power companies of Montreal. The commission was never appointed, but it is now proposed that the scope of its operations be extended to include the Great Lakes. Another commission is already at work studying the St. Lawrence River water-powers below Montreal, and will report to the Department of Marine and Fisheries. The work of the St. Lawrence and Great Lakes Commission will extend over a number of years and may result in the establishment of a permanent water-power bureau to which the government can go for expert information in connection with water-power applications. The commission will prepare reports which can be available in connection with the work of the Canadian section of the International Joint Commission. The latter body is constantly called upon to deal with important technical questions upon which there is little reliable information from the Canadian standpoint.

Anglo-American Exposition, 1914

The Philadelphia Commercial Museum, of which Mr. W. P. Wilson is director, has arranged to organize the American Industrial Section of the Anglo-American Exposition to be held in London from May to October, 1914. The time has been selected to celebrate 100 years of peace and progress of the English-speaking people since the Treaty of Ghent in 1814. The buildings for the exposition at Shepherd's Bush are now ready for the reception of American and British exhibits, practically one year before the opening of the exposition on May 1, 1914.

Status of Wisconsin Water Power Bill

After a lengthy debate in which several amendments were incorporated into the water power bill by the water power interests of the state, the Water Power bill has passed the Wisconsin State Senate. The bill, in substance, provides for the complete public control of water power by the Railroad Commission. The franchises must be given to utility corporations and therefore can be controlled as other utility corporations in which rates can be fixed and service ordered by the commission. The franchise is indeterminate, but the State can purchase at any time by paying full value. The bill provides for the taking over of any property by the State at the end of thirty years and the State will pay for the improvements, minus a certain amount for depreciation, for the value of the land and the riparian rights, but is not bound to pay for water rights. Following a previous court decision, the committee has not recognized the value of a franchise or water power right. An amendment to the bill provides, however, that riparian property, previously acquired, may be taken into account when the State takes over the property provided the price for such property was paid in good faith by the grantor of the franchise. This excludes the possibility of an unearned increment and confines the value to the price actually paid. There is one point still in dispute which will probably be the subject of an amendment before the bill passes the Assembly. The question at issue concerns the value of future franchises and the water power interests are making strenous efforts to amend the bill in some way so as to recognize the market value of these franchises.

Illuminating Engineering Society Convention

Coincident with the dates of the Pittsburgh (Pa.) convention of the Illuminating Engineering Society, Sept. 22 to 26, the city will be celebrating the one hundred and twenty-fifth anniversary of Allegheny County. There will be elaborate decorations by day and illumination features by night, making the occasion one of great interest to visitors.

Among the papers to be presented at the sessions are the following: "The Use of the Photo-Electrical Cell in Photometry," by Prof. T. R. Richtmeyer, Cornell University, Ithaca, N. Y.; "Characteristics of Enclosing Glassware," by Mr. V. R. Lansingh, New York; "The Quartz Mercury-Vapor Lamp and Its Applications," by Mr. W. A. D. Evans, New York; "The Fortune Lamp as a Working Standard," by Messrs. E. G. Crittenden and A. H. Taylor, Bureau of Standards, Washington, D. C., and "The Neon-Tube Lamp," by Mr. Georges Claude, Boulogne, France. Mr. Roscoe Scott, Cleveland, Ohio, will also deliver a lecture on "The Evolution of Illuminants."

The Philadelphia Section of the society is planning to present an historic gavel to the presiding officer of the convention. Mr. Robert Ely is chairman of the gavel committee.

San Francisco 1915 Congresses

Following the meeting of the International Electrotechnical Commission to be held in San Francisco during the week beginning Sept. 6, 1915, the International Electrical Congress will be held during the week of Sept. 13 in accordance with the plans outlined in their tentative form on page 230 of our issue dated Aug. 3, 1912. A comparison of the final with the tentative plans shows that the former two sections on wireless and wire communication have been combined as one while a new section on electrophysics has been created. Thus the total number of sections is twelve, as formerly provided for. The secretary of the committee on organization is Dr. E. B. Rosa, Bureau of Standards, Washington, D. C., who is also secretary of the congress. The president is Dr. C. P. Steinmetz, Schenectady, N. Y.

For the convenience of the manufacturers of minor devices special arrangements have been made by the department of machinery exhibits of the Panama-Pacific International Exposition to be held in San Francisco from Feb.

20 to Dec. 4, 1915. Several such manufacturers will be permitted to club together in applying for and utilizing exhibition space. An exhibit might consist, for example, of circuit-breakers, switches, fuses, porcelain goods and other supplies, although made by different manufacturers. Mr. A. M. Hunt, Exposition Building, San Francisco, is the chief of the department of machinery exhibits.

Colorado Convention of the American Electrochemical Society

The twenty-fourth annual meeting of the American Electrochemical Society will be held at Denver, Colo., Sept. 9, 10 and 11, with headquarters at the Hotel Shirley. For the second day's session, Wednesday, the delegates will go by electric car to the University of Colorado at Boulder, and Thursday's meeting will be held at the Colorado School of Mines, Golden. The concluding session of the convention will be held on Friday on the summit of Pike's Peak, following a pleasure trip to Manitou and the Garden of the Gods.

Among the entertainment features scheduled are automobile rides through the Denver park system, and up Boulder canyon to the plant of the Central Colorado Power Company at the entrance to the Boulder tungsten district. On Thursday evening there will be a picnic dinner on Lookout Mountain, near Golden. Besides Friday's Pike's Peak trip, the delegates will on Saturday journey to Cripple Creek via the famous "Short Line." Other special trips have been arranged for the ladies.

The Colorado convention will be marked by the first "Electrochemical Special" train, which is scheduled to leave the Grand Central Terminal, New York, at 10:30 a. m., Saturday, Sept. 6, and Chicago, Sunday, 9:45 a. m., reaching Denver, Monday, Sept. 8, at 1:15 p. m. The returning train will leave Colorado Springs, Saturday, Sept. 13, at 10:30 p. m., reaching Chicago at 9:15 Monday, and New York at 9:11 a. m. Tuesday. The trip from New York to Denver will be made over the New York Central and Burlington routes, returning via the Santa Fé. The highest grade all-steel Pullman equipment, electrically lighted, will make up the special train. Requests for railroad reservations should be made to the chairman of the transportation committee, Mr. J. M. Muir, 239 West Thirty-ninth Street, New York City. Dr. J. W. Richards, Lehigh University, South Bethlehem, Pa., is the secretary of the American Electrochemical Society.

Practice of Indiana Public Service Commission

The recently organized Public Service Commission of Indiana has adopted rules of practice and uniform classification of accounts for electric utilities as well as uniform classification of accounts for electric railways. An order has been issued directing all utilities to keep their accounts in conformity with the classifications of the commission. It is required that each public utility shall show in itemized detail (1) the depreciation per unit, (2) the salaries and wages separately per unit, (3) legal expense per unit, (4) taxes and rentals separately per unit, (5) quantity and value of material used per unit, (6) receipts from residuals, by-products, services or other sales separately per unit, (7) total and net cost per unit, (8) gross and net profit per unit, (9) dividends and interest per unit, (10) surplus or reserve per unit, and (11) prices per unit paid by consumers. In addition other items may be required as the commission may prescribe in order to show completely and in detail the entire operation of the utility in furnishing the unit of product or service to the public. Two separate schedules have been prepared. In general electric utilities operating in cities of 10,000 population or over will keep the accounts prescribed in Class A classification, while utilities in smaller cities will use the Class B classification; but this arrangement may be varied abitrarily if sufficient cause is shown to the commission.

The official address of the commission is Public Service Commission of Indiana, Indianapolis, Ind. Mr. Thomas Duncan is chairman of the commission, and Mr. J. L. Reiley is secretary.

J. Robert Crouse on the Society for Electrical Development

There are always some underlying, basic principles governing all change and progress, whether in the field of research, engineering, manufacturing or merchandizing. These principles are of the same essential quality as the axioms in mathematics or refined statements of particular relations, such as $I = \frac{E}{R}$ in our electrical business. Such principles do not depend for their truth upon minority or majority assent, and when once fairly stated, are assured of final acceptance since essential progress must be made in harmony with them.

Progress in our electrical business during thirty years (notwithstanding that less than 30 per cent of the population is electrically served) has been one of the wonders of the world; its contribution to the comfort, happiness and efficiency of our modern life are so great that we wonder how a preceding generation did without electricity. We may justly feel proud of such a magnificent business which in every department of its development is so worthy of our best thought and effort.

The efforts of those engaged in the fields of research, engineering and manufacturing have shown the most marked results, since, while enjoying the stimulus of the friendly rivalry of other men and organizations, they have been free from the sort of competition which makes the accomplishment of useful results expensive and difficult. It is a matter of common observation that rapid progress has been made in discovery and research, in efficient engineering adaptation of discovery to practical manufacture, and improved products tending to better conditions of generation, construction and distributing systems.

However, in the field of selling and distribution we are challenged by the cold fact that no essential progress—meaning by this a decreasing ratio of sales expense to sales—has been generally accomplished. Not only this, but there is a prevailing opinion among the manufacturers, jobbers, dealers and contractors that the ratio of sales expense to sales tends to increase. The annual reports of some of the largest electrical manufacturers makes specific mention of this tendency as a fact in their operation. Among central stations this is doubtless less true, since by common consent they are properly monopolistic for the best results and competitive only with other methods of furnishing service for light, heat, power and other useful purposes.

Our electrical business, technical in its very nature, has doubtless for that reason placed less emphasis in the past on aggressive selling and distributing effort—witness the fact that the first commercial papers in the National Electric Light Association appeared only so recently as 1905, and national advertising by individual companies began about 1907, 1908.

It is estimated that the gross sales, ratio of sales expense and sales expense for 1912, in the electrical business, were approximately as indicated in the following table.

The $80,000,000 of sales effort (which is equal to one-fifth of the gross sales of all the central stations) is incurred by approximately 5000 central stations, 500 manufacturers, 200 jobbers, 5000 dealers and contractors—a total of 10,700 organizations. It is of special importance

to note that $60,000,000 of this $80,000,000 sales effort is incurred by the manufacturers, jobbers, dealers and contractors who operate under complete competitive conditions, at a sales expense ratio of at least 15 per cent, and tending to increase.

While this table and the above comments are broad generalizations, the reader is asked to check the principle and its application in his own particular case.

Branch of Business	Gross Sales 1912	Per Cent Ratio Sales Expense to Sales	Sales Expense, 1912
Central Stations	$400,000,000	5	$20,000,000
Dealers and Contractors	100,000,000	15	15,000,000
Manufacturers and Jobbers	300,000,000	15	45,000,000
Total	$800,000,000		$80,000,000

These facts in themselves are a challenge to commercial men, which cannot be avoided. They justify the most careful search for causes and investigation of plans for improvement.

Whatever minor causes may be contributory to this failure in more efficient merchandising, the major one, which experience and the facts disclose, is competition among these thousands of companies, resulting in expensive duplication of all kinds of sales efforts and failure to co-operate in a definite organized plan in those kinds of endeavor which supplement legitimate competition.

This competition is to a very great extent to secure the business held by others or of natural growth—which we may characterize as the existing market. A very large part of the selling effort is exerted on this existing market and dissipated in commercial friction and lost motion, with resulting decrease in its creative effect.

The fact is frequently overlooked that the energy-consuming devices for light, heat, motor service and other useful purposes are the only aspects of our business in which the public are or can be interested, while they constitute only a small part of the resulting business from the boilers to the devices the public uses. We are therefore all, without conscious organization, joint sellers of the final service.

The age of business (in which someone has said we live to do business, instead of doing business to live, in the best sense) is in the order of social development the successor of the period when war—the extreme of competition—was the principal occupation. Business has inherited from this prototype many habits of enmity, antagonism and waste, which only the persistent cultivation of good fellowship, harmony and economy will gradually supplant. The most successful organizations which I have observed have given the greatest attention to the cultivation of harmony among their men, and the spirit of progressive, constructive effort. This same result must measurably follow similar conscious effort by an entire industry.

The Society for Electrical Development proposes a broad, common organization of our entire industry: central stations, manufacturers, jobbers, dealers and contractors (controlled by a balanced representation from each), through which a part of this $80,000,000 of unorganized and competitive sales effort can be more effectively exerted through organized and co-operative effort in promoting and popularizing electrical service. These plans to teach the public to "Do it electrically"—many more than can at once be undertaken—have been worked out and endorsed as entirely practical by many prominent men in our business.

The Society proposes at the start that a minimum of $200,000 or only one-fourth of 1 per cent of this $80,000,000 of competitive sales expense, be co-operatively expended. The basis of subscription is for manufacturers, and central stations, one-fifteenth of 1 per cent of gross sales, and for jobbers, dealers and contractors one-twentieth of 1 per cent, amounting, for illustration, in the case of the former, to $66.66 per $100,000 of gross business, and in the latter case to $50 per $100,000 of gross business—the subscription being on an annual basis. This means in the case of a company having a 15 per cent sales expense account, only one-three-hundredth of its sales appropriations. There are few organizations which cannot locate competitive expenses of doubtful value equal to the society's subscription. While individual subscriptions are comparatively small and in no sense burdensome, yet general co-operation in the movement will make a fund of $500,000 per annum available for progressive and aggressive market cultivation along these new lines.

This society creates the organization and the fund through which some of our dollars can co-operate with the good will of us all in broad effective activity for the expansion of the market, while we continue with the most of our dollars to compete for our fair share.

This plan means real progress in the direction of more efficient distribution of electrical service through joint cultivation of our common market—the great pre-occupied, incredulous, money-spending public—a result which our present systems neither accomplish nor promise ever to achieve on the old lines.

The plan presents a new kind of consolidation for sales efficiency through a better balance of competitive and co-operative effort to which the popular thought will not now nor in future take exception.

The plan means that men identified with the most wonderful of all businesses will demonstrate for themselves and by example for others the true principles which underly progress in more efficient sales distribution, through the creative cultivation of the market. The plan lends dignity to the art of selling—synonymous in the best sense with service—and marks a further point in the age now happily passing, when the selling spirit was symbolized in the economist's expression *caveat emptor*—"Let the buyer beware."

Building Trades Strike Settled in Chicago

Following a basis of settlement reached by a joint conference committee, the men affected by the general strike and lockout in the building trades of Chicago returned to work on July 21. The dispute had nothing to do primarily with wages, hours of work, or recognition of the union. The employers objected to the employment of "maintenance men" on jobs of electrical construction work and to the vexatious clashes of the unions themselves as to jurisdiction over certain classes of work. The original strike, followed by a general lockout, was begun on June 12. Over 20,000 men were involved, and work on all large buildings under construction was stopped for over a month.

The joint conference committee represented the Building Construction Employers' Association and the Building Trades Council. After numerous sessions it decided to create a permanent joint arbitration board, to which any future disputes may be referred. It also reached decisions on many of the points involved. In relation to the use of maintenance men in electrical work, the conference committee adopted the following resolution:

"Resolved, That in view of the statement of Mr. Cleary, representing the Electrical Workers' Union, local No. 134, that no contractor shall be compelled to employ so-called maintenance men, it is mutually agreed by the joint committee that where men are required to do electrical work it shall be at the option of the employer and that union electricians shall be employed."

This upholds the employers' contention. The claim of the hoisting engineers for the use of maintenance men was referred to the arbitration board when formed.

The jurisdictional claim of the ornamental iron-setters and electric-fixture workers in reference to the erection of ornamental and monumental bronze fixtures was decided as follows: "That all ornamental and monumental iron and bronze lamp standards which are a part of ornamental iron and bronze contract and manufactured by members of the

Iron League of Chicago, or by manufacturers engaged in a similar line of business, shall be erected solely by members of the Architectural Iron Workers' Union, as has always been the custom."

Field work necessary for the erection of coal and ash conveyors and package conveyors, claimed by the machinists, was awarded to the millwrights.

Boiler makers are conceded the work of assembling and erecting water-tube boilers, machinery movers to deliver boilers or parts to their foundations.

Other stipulations of this kind are made in relation to the jurisdiction of structural iron workers, lathers, building laborers, cement finishers, carpenters, glaziers, sheet-metal workers, asbestos workers, machinists, steam fitters, and others.

Where disputes are referred to the board of arbitration in the future there shall be no cessation of work during arbitration. The work of the conference committee was conducted in a friendly spirit, and there is a hopeful feeling that a way has been found to do away with the almost constant strikes and bickerings that have characterized building operations in Chicago in the last few years.

The Building Construction Employers' Association of Chicago represents the prominent building contractors. The electrical contractors on the executive board are Messrs. John Cuthbert, Ernest Freeman and G. A. E. Kohler. Mr. Kohler is third vice-president of the association and is a member of the joint conference committee.

Convention of the National Electrical Contractors' Association

The thirteenth annual convention of the National Electrical Contractors' Association was held in the Hotel Patten, Chattanooga, Tenn., July 16, 17, 18 and 19. The registered attendance was 214, 115 of whom were members, the remainder being guests and ladies. On the day preceding the convention the contractors traveling on special cars from New York, Chicago and St. Louis were entertained at the Sinton Hotel, Cincinnati, by the electrical contractors of that city. A tour of Cincinnati was made on special trolley cars which ended with a visit to the zoological garden, where dinner was served, Mr. L. T. Milnor acting as toastmaster. Speeches were made by the Hon. H. T. Hunt, mayor of the city, Mr. J. C. Hatzel of New York City, second vice-president of the National Electrical Contractors' Association; Mr. W. E. Robertson, electrical jobber of Buffalo, N. Y.; Mr. J. M. Wakeman of the Society for Electrical Development, Inc.; Mr. Victor Price, director of public service; Mr. G. W. Sullivan of Cincinnati, and Mr. F. D. Lawrence, manager of the General Electric Company's Cincinnati office. A cabaret performance was given in the course of the dinner and special cars left the zoological garden at a quarter to nine for the Central Union station. A special train in charge of Mr. V. C. Gilpin, master of transportation, left Cincinnati at 10 o'clock, arriving in Chattanooga the following morning.

The first official session of the association was held on the morning of July 16 when the visitors were welcomed formally to the city. The first speaker was Mr. Joseph A. Fowler of the Tennessee State Association, who made a short talk and introduced President Ernest Freeman, who made the opening address. Mr. Freeman paid many glowing tributes to Chattanooga, and was followed by Commissioner H. Clay Evans, who welcomed the visitors on behalf of the State of Tennessee. Mr. Evans detailed the possibilities of Chattanooga for the future and told of some of the wonderful developments that are now under way. Mr. T. C. Betterton, on behalf of the city of Chattanooga, also welcomed the visitors, and in a speech calling attention to the hydroelectric developments on the Ocoee River and on the Tennessee River predicted a broad future for the electrical business of Chattanooga saying that within a very short time over 125,000 hp would be available for manufacturing purposes in that historic city. The last speaker of the session was Mr. A. M. Schoen of Atlanta, Ga., who represented the Southeastern Underwriters' Association. Mr. Schoen spoke of the National Electrical Code and dwelt upon the relations that should exist between the electrical contractor and the underwriters' inspector.

Business Sessions

The remaining sessions were open to members only. On the afternoon of July 16 reports were read by the President Ernest Freeman of Chicago, Mr. John R. Galloway of Washington, D. C., treasurer, and Mr. W. H. Morton of Utica, N. Y., secretary. Mr. Freeman's report was quite optimistic in tone and in it he dwelt on the relations existing between the jobbers and contractors. He also made a plea for closer co-operation between the various electrical interests, closing with a resumé of the general work conducted by the association. According to the report of the treasurer the National Electrical Contractors' Association was never in a better condition financially and Secretary Morton's report revealed the fact that on June 1, 1913, the total membership of the association was 1268. During the session a telegram was received from Mr. J. Robert Crouse of the National Quality Lamp Division of the General Electric Company, Cleveland, Ohio, bearing expressions of good cheer and stating that the contractors' association was worthy of congratulation for the progressiveness displayed during the year and for the co-operative work done by it in creating harmonious relationships with other national bodies engaged in the electrical business.

During the afternoon session Mr. Morton tendered his resignation effective Sept. 1 as secretary, stating that he was going to leave within a short time for Porto Rico, where he has organized a large company to exploit grape fruit plantations. Inasmuch as Mr. Morton has been connected with the organization ever since its formation thirteen years ago, his resignation was received with much regret, and President Freeman appointed as a committee on resolutions all of the past presidents of the association present, comprising Messrs. Ernest McCleary of Detroit, James R. Strong of New York; Gerry M. Sanborn of Indianapolis, and Marshall L. Barnes of Troy, N. Y. This committee introduced a set of resolutions thanking Mr. Morton for the work he had done while secretary of the National Electrical Contractors' Association, recalling his valuable services and concluding with well wishes in his new undertaking. The resolution was unanimously adopted by the convention.

The rules of the National Electrical Code were brought up by Mr. Ernest McCleary of Detroit, the committee on that subject, during the afternoon and the greater part of the session was allotted to the speaker, who explained the recent changes made in the rules at the biennial meeting held in New York City last March. He also answered questions relative to Underwriters' decisions.

Guaranteed Wiring

At the afternoon session Mr. McCleary also read the editorial appearing in the *Electrical World* of July 5, in which it was suggested that the National Electrical Contractors' Association guarantee the work of its members. The scheme proposed was that every member of the association should undertake to carry out interior wiring contracts in strict conformity to the rules in force, the association to stand back of the guarantee by agreeing to indemnify the employer of any of its members against bad workmanship or materials, and that any member failing to remedy defective work after being notified by the association to do so should be dropped from the organization. The scheme suggested called forth a very general discussion and it was felt that its adoption would redound to the credit of the association as a whole, and give it and its members a

better standing with the central-stations and with the communities in which the contractors were engaged in business. On motion the suggestion was referred to the executive committee of the association with instructions to investigate the proposition in all its details and to report its findings at a subsequent meeting.

The reports of the various standing committees were also presented at the afternoon session, discussion on them coming up during the other days of the convention.

Co-operative Movement

During the Thursday session Mr. J. M. Wakeman of New York City, general manager of the Society for Electrical Development, Inc., made an interesting address on the purpose and scope of that society. He dwelt at length on the plan of the organization to bring about better conditions both for the contractors and for the consumers, and his talk was strongly endorsed by a number of contractors present who told of the good they themselves had experienced from membership in the Society for Electrical Development, Inc. As a result of the discussion which followed, twenty-four contractors made applications of membership in the society.

Segregated Contracts

The committee reports read at the session on Wednesday were taken up and discussed at some length and other executive matters were also taken up. The contractors expressed themselves freely on the policy followed by architects of making a general contract to cover all work so that the successful general contractor in sub-contracting the electrical work used one contractor against another to the detriment of the entire trade. It was the sense of the meeting that the National Electrical Contractors' Association suggest to the American Institute of Architects the segregation of contracts so that this practice of using one contractor against the other might be stopped. Attention was also called to a law recently passed by the Pennsylvania Legislature enacting that in the preparation of specifications for the erection, construction and alteration of any public building when the entire cost of such work should exceed $1,000 it shall be the duty of the erecting engineer or other person preparing such specifications to prepare separate specifications for the plumbing, heating, ventilating and electrical work, and it shall be the duty of the person or persons authorized to enter contracts for the erection, construction or alteration of such public buildings to receive separate bids upon each of the said branches of work and to award the contract for the same to the lowest responsible bidder for each of said branches.

The sessions on Friday were devoted chiefly to matters of business and during the morning addresses were delivered on subjects pertinent to progress and policy of the organization.

Cost Keeping for Contractors

Mr. F. L. Decker explained the bookkeeping system adopted by the National Electrical Contractors' Association, which is sold to members for $15, and to non-members for $20. An instruction book goes with the system. It was felt that the plan which has been devised for handling a job from beginning of construction to completion and which forms a part of the bookkeeping scheme is worth in itself many times the cost of the system. Investigations showed that the cause of a large majority of failures on the part of the contractor are due to lack of proper accounting methods and ignorance of true financial conditions. In the hope of improving this feature of the business the National Electrical Contractors' Association set about to find a remedy, and the report of Mr. Decker on the bookkeeping system is the result. The two important features of the system are that it shows first how much money has been made or lost on every job no matter how large or how small, and secondly, the true status of the business at the end of every month. In order to make the system, which in itself is very simple, more comprehensive a book of explanation setting forth step by step how every item or transaction is to be handled, has been made a part of the system.

Standardization of Finishes

One of the other important reports taken up during the morning session was made by Mr. G. M. Sanborn, of Indianapolis, on the standardization of finishes. The association hopes to induce manufacturers to adopt standard finishes of fixtures, sockets, wall plates, etc., by distributing to its members numbered samples and requesting them to order from manufacturers by number, thus compelling the latter in filling the order to adopt or refer to the standards of the contractors. For instance, if a contractor desired a brush brass finish on fixtures, wall plates, etc., and his samples designated the finish as No. 18 he would merely note on his order to the manufacturer that he desired No. 18 finish.

Standard Conduit for Wiring Installations

Another movement toward standardization comprises a set of six charts of standard sizes of conduit for the installation of wires and cables adopted by the National Electrical Contractors' Association and explained in detail during the meeting. The disposition in the past has been to use conduits of too small interior diameter and in the preparation of the charts care has been taken to recommend conduits of sufficient size to cover all work, bearing in mind at the same time that economy in installation should be considered and extravagant sizes in conduits discouraged. The charts adopted were prepared after careful study of the actual conditions encountered in making installations and show the conduit and conductors' full size so as to give a visual representation of the actual condition, in addition to showing the size of conduit needed for each combination of wires. The charts gave the actual diameter of the conduit and the current carrying capacity of the wire used in accordance with the changes made in the National Electrical Code. The complete set comprises six charts which show the proper size of conduit for one, two, three, four and convertible three-wire systems combinations of duplex wires in sizes of Nos. 10, 12 and 14; single wire combinations of No. 14 wires up to No. 90 wires; combinations of No. 16 and No. 18 fixture wires up to 150 wires and combination of telephone wires up to 50 pairs. The charts are substantially framed, hinged together and provided with a backing for convenient hanging, two charts being mounted on each sheet so that there are only three frames in the set.

Universal Data and Sales Book

Mr. Sanborn in his report on a universal data and sales book issued by the National Electrical Contractors' Association to its members under lease, drew attention to many of the clauses appearing on the title page of the book, to the effect that there is no understanding or agreement on the part of the National Electrical Contractors' Association or among its members or otherwise, fixing or in any way effecting the price of the material listed in the book, such listing being made only for the convenience of members. Moreover, there is no understanding or agreement on the part of the association or among its members or otherwise that purchases shall be limited to the material so listed. Members are entirely free to buy where they please and sell at any price they please and there is no desire on the part of the association or its executive committee to hamper or interfere in any way with the members' rights in the respects mentioned.

Relations with Jobbers

One of the most impressive addresses made at the convention was delivered by Mr. W. E. Robertson, of the Rob-

ertson-Cataract Company, of Buffalo, N. Y., who defined clearly the respective fields of the jobber, dealer and the contractor, showing that the tendency is toward larger and fewer jobbing houses; more dealers, who will be recruited both from jobbers and contractors, and better and more responsible contractors. The speaker expanded on the excellent results to be obtained by close co-operation between jobbers, dealers and contractors, and by a proper appreciation by each of the definite and respective fields of the others.

At the Friday afternoon session after one of the most spirited contests ever held it was decided to hold the next convention of the association in Detroit, Mich. Minneapolis, Detroit, Richmond, New Orleans, New York and Troy were all placed in nomination, and the merits of each championed by contractors from the respective cities. The fight grew so hot that all proxies were called for, with the result that Detroit won. Owing to the great heat attending the meeting in Chattanooga it was also strongly urged that the association hereafter hold its annual meetings in the spring of the year.

ELECTION OF OFFICERS

On the recommendation of the nominating committee the following officers were elected: President, Mr. Ernest Freeman, of Chicago; first vice-president, Mr. J. C. Hatzel, of New York; second vice-president, Mr. W. L. Hutchison, of Kansas City; third vice-president, Mr. J. C. Rendler, of Los Angeles; treasurer, Mr. J. R. Galloway, of Washington, and sergeant-at-arms, Mr. J. C. Sterns, of Buffalo. Mr. W. H. Morton was re-elected as secretary of the association with the understanding that the executive committee will fill the position before Sept. 1, when Mr. Morton's resignation becomes effective. The committee has already taken steps to advertise for applicants for the position, the duties of which besides looking after the routine work of the secretary's office include editing the *National Electrical Contractor*, the official monthly organ of the association.

Mr. Ernest Freeman, who has been re-elected president of the National Electrical Contractors' Association, is president of the Freeman-Sweet Company of Chicago. He was born in Chatham, Mass., in 1870, and as a young man went to Chicago and entered the electrical field. His experience has not been limited to contracting work, however, he having been at one time connected with the central stations at Libertyville and Morris, Ill., and with the Consolidated Water & Light Company of Marseilles, Ill., having been president and manager of the latter company. The first two properties are now part of the Public Service Company of Northern Illinois, and the last property is now in the McKinley group. For several terms Mr. Freeman was president of the Chicago Electrical Contractors' Association. Being a man of progressive and broad experience he has contributed liberally toward uplifting the standard of electrical construction work and is recognized as one of the most active and influential members of the national body.

ENTERTAINMENT FEATURES

In addition to the entertainment provided for the delegates en route to Chattanooga by the electrical contractors at Cincinnati, the local committee at Chattanooga provided abundant recreation during the week. The reception and dance was held in the ball room of Hotel Patten on the evening of July 16, Mr. and Mrs. E. Freeman and Mr. and Mrs. J. Fowler being the committee in charge. Owing to the great heat which prevailed during convention week there was very little dancing, the members and guests being entertained with a negro cake walk.

There being no session allotted for the afternoon of July 17 the entire party was taken in automobiles to Chickamauga Park, passing over the battle fields and returning by way of Missionary Ridge. This trip was considered to be one of the most interesting ever given in connection with the annual gatherings of the organization, and every available sight-seeing automobile in the city was pressed into service. Stops were made at various points in Chickamauga Park and on Missionary Ridge to permit the visitors to obtain closer views of the monuments as well as views of the battle fields from observation towers. In the evening an illustrated lecture on window lighting was given in the hotel ball room by Mr. J. F. H. Aldrich, of the National X-Ray Reflector Company of Chicago. Immediately following the lecture there was a rejuvenation of the Sons of Jove, and ten new members were initiated into the mysteries of the order, Past-Jupiter W. E. Robertson acting as Jupiter.

In the afternoon of July 18 an afternoon tea was given to the ladies and guests of the association in the Hotel Patten by the Chattanooga Electric Club, a local quartet contributing to the entertainment of the guests by some well chosen selections.

The great event of the week was the annual dinner which was given in the main dining room of Hotel Patten on the night of July 18. A book of songs was distributed and all were invited to join in the singing led by Mr. J. R. Strong, of New York. Humor appropriate to the day and occasion, puns on members present and other genial fun made the affair very enjoyable in spite of the heat. After the dinner a vaudeville performance was given by professional actors from a local theater.

On Saturday morning the entire party was taken in automobiles to Signal Mountain, where lunch was served in the grove surrounding the Signal Mountain Inn. The trip was through a very pretty section of the valley in which Chattanooga is located and over a new driveway up the famous Waldron's Ridge. In the afternoon the party left on a special train to visit the lock and dam of the Chattanooga & Tennessee River Power Company, now nearing completion, at Hales Bar, some 33 miles from Chattanooga. The special train returned to the city shortly after 6 o'clock, when the convention disbanded.

Society of Heating and Ventilating Engineers

At the semi-annual meeting of the American Society of Heating and Ventilating Engineers, held at Buffalo, N. Y., July 17 to 19, were presented several papers of interest to our readers.

In a paper entitled "Time Analysis in Starting Heating Apparatus" there was given a mathematical discussion by Mr. Ralph C. Taggart, New York, of the methods of computing, with the aid of the calculus, the time interval required to heat radiators, pipes and other equipment.

A paper on "Expense of Operating Heating and Ventilating Plants," by Mr. H. M. Hart, Chicago, contained actual data for school and office buildings. The information obtained for residences and apartment buildings was, however, of such a conflicting character that no extended mention could be made of these classes.

Mr. Frederick Bass, Minneapolis, reported experiments in school-room ventilation with reduced air supply through individual ducts. In these tests made at Minneapolis ozone was introduced in the proportion of one part to 1,000,000 parts of air. It was found possible to "renew" the air in a fully occupied schoolroom for a period of three hours without admitting outside air, all the time keeping the air within sweet and comfortable and the occupants at full normal efficiency. Continuation of these conditions five hours a day for three weeks had no perceptible effect on the children who were under the inspection of expert physiological and psychological observers. "Apparently the ozone was an important factor in keeping the air of the room in a comfortable condition," commented the author, for once during the test the small fan supplying the ozone

was put out of commission temporarily and the effect was noticed by the teacher within twenty minutes. The results obtained show conclusively that in rooms and halls only occasionally used the revolving and renewing of the air by proper treatment are as desirable as the introduction of outside air. Persons may occupy such rooms ventilated by renewed air for long periods of time without suffering or exhibiting any effect, either consciously or unconsciously. Air leakage will supply more than enough oxygen.

A paper by Mr. Frank L. Busey, Buffalo, described results obtained from a recent set of experiments made to determine the loss of pressure due to elbows in the transmission of air through pipes or ducts. Heat transmission with pipe coils and cast-iron heaters under fan-blast conditions was the subject of a paper by Mr. L. C. Soule, Chicago.

Statistics of Electrical Installations in Chicago

By city ordinance all electrical wiring and electrical equipment within the city of Chicago must be inspected and approved by the Bureau of Electrical Inspection of the Department of Electricity. The records of this department give, therefore, an interesting summary of electrical installations in Chicago. Thus, the recently published report of the department for the year 1912 gives the number of electric-lighting installations and lamps in the city under the jurisdiction of the department as expressed in the accompanying table.

TABLE I—STATISTICS ON ELECTRICAL GENERATING PLANTS

	Stations	Arc Lamps	Incandescent Lamps
Commercial companies, central stations	20	15,357	4,829,035
Isolated plants	786	20,261	903,469
*City plants, street lighting	10	13,830	862
City plants, isolated, including water works	13	80	3,449
Totals	819	49,528	5,736,815

*Energy furnished by the Sanitary District of Chicago.

TABLE II—STATISTICS REGARDING THE CONNECTED LOAD OF THE CHICAGO CENTRAL STATIONS

	Lamps		Motor, Horsepower
	Incandescent	Arc	
Gunther Electric Co.	11,500	18	304
Cosmopolitan Electric Co.	111,331	119	8,340
Adams Generating Co.	3,101	4	3
Dearborn Power Co.	2,307	17	393
Monroe Electric Co.	420	8	10
Zenith Electric Light Co.	5,280	12	11
Chicago Cold Storage Warehouse Co.	1,800	.....	370
Fort Dearborn Building	75	.....	3
Hartford Building	2,500	5	50
Dolton Electric Light Co.	57	.....	.....
Commonwealth Edison Co. (four plants)	4,578,786	14,874	215,972
Inter Ocean Newspaper Co.	5,000	17	253
Union Stock Yards & Transit Co.	11,632	18	2,477
First National Bank Building	5,000	.....	100
Sanitary District of Chicago	23,173	265	15,877
Public Service Company of Northern Illinois	66,360	.....	319½
North American Building	773	.....	29½
Total, 20 plants	4,829,035	15,357	244,512

The number of commercial central-station companies furnishing electrical energy in the city of Chicago is larger than is generally supposed and is shown by the records of the Department of Electricity in Table II.

The total number of electric signs in the city at the close of 1912 was 7241. Of these 6650 projected over sidewalks, 523 were mounted parallel with buildings, and 68 were roof signs. The total number of incandescent lamps used in these signs was 475,839.

Electric-Rate Discussion in Chicago

The reading of the report of City Electrician Palmer on the rate investigation of the Commonwealth Edison Company was resumed by the committee on gas, oil and electric light of the Chicago City Council on July 16. One point brought out was whether the situation by which the Commonwealth Edison Company sells energy to the street-railway companies results in a double charge for depreciation paid by the people of Chicago. The central-station company, owning and operating the machinery producing the energy, naturally makes a charge for depreciation. Under the 1907 traction-settlement ordinances, as construed by the Board of Supervising Engineers, Chicago Traction, the street-railway companies have also apparently the right to make a charge for depreciation on power plants that might be necessary to produce the energy which they purchase from the Commonwealth Edison Company. Alderman Merriam argued that this double charge was unjust to the people, and Mr. C. B. Willard, the expert accountant from the city comptroller's office, agreed that it might be so. However, Mr. Willard explained that this practice on the part of the street-railway companies allows them to make a better showing in relation to operating expenses, and that the city gets 55 per cent of the "net divisible receipts" thereby increased.

Valuation of Harrison Street Station

There was some discussion also on the proper valuation of the Harrison Street generating station of the Commonwealth Edison Company. This station was put in service in 1902, and, with its reciprocating engines, is now regarded as of an obsolescent type. It is used to some extent as a substation, although until recently was sometimes pressed into service during the peak load of the winter months. This station is valued at $2,500,000 in the Palmer report, and some of the aldermen appeared to think that this valuation is too high.

Low Rates in Railway Contracts

At the meeting of the committee on July 17 the reading of the Palmer report was concluded. Mr. A. C. King, assistant city electrician, who collaborated in the preparation of the report, explained, at the request of Alderman Merriam, the long and elaborate contract of 1913 by which the Commonwealth Edison Company agrees to supply electrical energy to the Chicago Railways Company until 1927. Mr. Merriam desired to know the rates provided in these street-railway contracts. Mr. King explained that there was a sliding monthly rate of $1.25 to 83⅓ cents per maximum demand in kilowatts. Similarly the secondary rate for consumption of energy is based on a sliding scale ranging from 0.4 cent to 0.36 cent per kw-hr. In any case a large demand and a large consumption are required, while to earn the minimum rates mentioned in the contract the demand and the consumption must be very large, running up to 100,000 kw in demand and 300,000,000 kw-hr. in consumption.

City Electrician Palmer read a letter which he wrote to Mayor Harrison last January on the subject of this contract and now made public. Before the revised contract was adopted it was necessary to obtain the consent of the city through the Board of Supervising Engineers. Mr. Palmer criticised the contract as on the whole favoring the street-railway company unduly and as being unfavorable to the electric-service company, the city of Chicago and the small consumers. Mr. Palmer figures that the

Commonwealth Edison Company's primary cost per unit of maximum demand in 1911, including depreciation, was about $14. The maximum primary charge under the contract is $1.25 a month, or $15 a year. This, however, decreases with increased demand to $10 a year, and Mr. Palmer thinks that the latter figure is too low, as it is not probable that improvements in the art will justify the decreased rate as the maximum demand increases. Therefore, the rate, in Mr. Palmer's judgment, will place an undue burden on the other customers of the company. At the present time the company receives a return on its investment, including depreciation, under this contract, of about 6⅔ per cent, but the future return may not be so good.

EMERGENCY CONNECTION FOR STREET LIGHTING

Another point brought up by Mr. Palmer in the oral discussion was in the nature of a warning against depending exclusively on hydroelectric energy delivered over a 30-mile transmission line for street lighting in Chicago. Not only is the Sanitary District approaching its limit in the matter of furnishing electrical energy for street lighting in Chicago, owing to the government's restriction on the use of water by the Drainage Canal, but the city electrician would like to see a tie line between the Fisk Street station of the Commonwealth Edison Company and the Western Avenue terminal station of the Sanitary District as a precaution for emergency service. The posssible use of garbage incinerating plants operated by the municipality as an auxiliary to the Sanitary District plant in electric street lighting was discussed informally.

POINTS MADE BY COMPANY REPRESENTATIVES

Mr. W. J. Norton, of the Commonwealth Edison Company, made a demonstration for the benefit of the aldermen of the use of the watt-hour meter and Wright demand meter on customers' premises. The instruments were mounted on a board which also supported a bank of lamps, and the measurements of various combinations of carbon and tungsten lamps in relation to energy consumption and maximum demand were explained.

Mr. W. G. Beale, counsel for the Commonwealth Edison Company, added a popular exposition of the maximum-demand principle in rate-making as related to peak load. He used the comparison of two men bargaining with a stable-keeper for the use of a saddle horse an hour a day. One customer, A, desires a horse reserved for him every day between 8 and 9 a. m. Another, B, says that he must have the use of the horse for one hour at any time during the twenty-four hours. The stable-keeper could obviously make a lower rate to A than to B.

In informal discussion Mr. Beale brought up several questions, such as the value of the franchise of the company, rates of depreciation and what effect the existence of the Public Utilities Commission of Illinois after Jan. 1, 1914, will have on the proposed contract ordinance under discussion. The company was given ten days in which to prepare a written answer to the arguments in Mr. Palmer's report.

Public Service Commission News

MARYLAND COMMISSION

A hearing on the application of the Consolidated Gas, Electric Light & Power Company for permission to lease the plant of the Patapsco Electric & Manufacturing Company was given by the Maryland Public Service Commission last Friday and the application granted. The Patapsco Company was formerly owned by Victor G. Bloede, who tried in vain to get a franchise from the City Council to supply electricity in Baltimore.

OHIO COMMISSION

Authority has been given the Cleveland Electric Illuminating Company of Cleveland to issue $2,000,000 common stock to be sold at par or above, and $1,000,000 in 5 per cent bonds to be sold at not less than 95. The proceeds are to be used to reimburse the company for improvements and betterments already made.

The Sandusky River Power Company of Fremont has received authority to issue $75,000 6 per cent mortgage notes to be used in borrowing money to make repairs on its property and provide against the recurrence of floods in the Sandusky River. The plant was damaged by the great March floods which devastated this state.

NEW YORK COMMISSIONS

The Long Island Railroad Company and the New York Consolidated Railroad Company have been ordered by the Public Service Commission for the First District to equip each of their electrically-operated cars with one or more chemical fire extinguishers of such a type that the contents thereof cannot act as an electrical conductor. The cars must be so equipped by Sept. 15, and if any other kinds of fire extinguishers are used, such other extinguishers must be conspicuously labeled that they are not to be used until the circuit has been opened. This action was taken following an investigation into a recent accident upon a trestle at Jamaica where a car of the New York Consolidated Company caught fire and was destroyed. It was found that the car had carried no fire extinguishers whatever.

CALIFORNIA COMMISSION

The Railroad Commission has rendered a decision granting authority to the San Joaquin Light & Power Corporation to issue $1,776,000 of bonds. It was also given authority to pledge these bonds for an issue of two-year 6 per cent collateral trust notes. The proceeds from the sale of the bonds or notes are to be used by the company in completing its power houses, sub-stations and transmission lines in connection with its new hydroelectric work.

The Railroad Commission has rendered a decision denying the application of the San Diego Consolidated Gas & Electric Company to issue 3148 shares of its common capital stock of the par value of $314,800. The corporation applied for authority to issue the stock to pay the discount upon its bonds issued since March, 1909.

MASSACHUSETTS COMMISSION

Hearings were concluded at Northampton, Mass., on July 11 by the Gas and Electric Light Commission, which is investigating the local gas and electric rates upon petition of the city authorities. On the closing day the prices charged for electricity by the Northampton Electric Light Company were considered by the board. For the city Mr. Alton D. Adams, of Worcester, Mass., contended that the existing average price of 3.8 cents per kw-hr. for energy for motor service discourages proper development. Mr. Adams said that the connected motor load is but 700 hp, compared with 1800 hp in Greenfield, which has an average rate of 2.3 cents. The maintenance of a minimum charge of $1 per hp per month in motor installations was also criticised. The speaker advocated fixing a street-lighting price upon a rate of 5 cents per kw-hr., the present return being 7.2 cents. He advocated an average commercial lighting price of 7 cents per kw-hr. in place of 10.44 cents, the existing average. The reductions desired by the city would lower the company's income from $108,584 to $77,123. Mr. Guy M. Cox, of Boston, counsel for the company, argued that the income ought not to be reduced by more than $10,000. He pointed out that the management is about to spend $85,000 in doubling the capacity of the plant, and that expenditures totaling $100,000 are in sight for underground construction. The territory requires an unusual investment in distributing lines. The company felt itself entitled to 6 per cent dividends on an investment of $281,621, or about $17,000, compared with the city's estimate of $12,679 on a capitalization of $117,400. The board took the case under advisement.

Current News Notes

Parcel Post Rates.—Manufacturers, jobbers and dealers who make extensive use of the parcel post for shipping electrical specialties will be interested in the plans for the extension, improvement and reduction in rates announced by Postmaster-General Burleson to become effective Aug. 15. The maximum weight of parcels has been increased from 11 to 20 lb. and a material reduction in the postage rates in the first and second zones will be made. In addition the parcel post map used in computing rates will be abandoned and as a substitute a rate chart will be issued individualized to every post office in the United States. The insurance fee which was originally 10 cents for values up to $25 was reduced to 5 cents on July 1.

* * *

Fight at Providence Settled.—The contention existing between the Rhode Island Transmission Company which is owned by the New England Power Company and the Narragansett Electric Lighting Company of Providence, R. I., has ended by the conclusion of a 30-year contract between the transmission company and the Narragansett Electric Lighting Company. Under the contract the New England Power Company will wholesale hydroelectric energy to the Narragansett company, which will distribute it over the entire district. The New England Power Company will also secure entrance on favorable terms to the great manufacturing section of Rhode Island. It is understood that the agreement was brought about chiefly through the influence of the Public Policy Committee of the National Electric Light Association.

* * *

Philadelphia Board of Lighting Supervisors.—Mayor Blankenburg of Philadelphia, Pa., has appointed a Board of Lighting Supervisors composed of Messrs. C. W. Pike, chief of the Electrical Bureau; Dr. H. Godfrey, chief of the Bureau of Gas, and G. E. Mapes, chief of the Bureau of Lighting. Among the duties of the board will be the consolidation of all charts, maps and other records of gas, gasoline and electric lamps into a correlated group. It will also make a systematic study of the lighting conditions in Philadelphia with a view to co-ordinating properly the use of the three illuminants; to standardize the lighting according to the character and importance of streets and to locate lamps to the best advantage. The division of authority heretofore existing between three bureaus was necessarily lacking in efficiency, and owing to the divided authority there was often an unsatisfactory mingling of the different illuminants on the same streets.

* * *

Railroad Terminal Discussion in Chicago.—The railroad terminals committee of the Chicago City Council, which has in charge the proposed relocation of trunk-line railroad terminals in Chicago, has appointed Mr. John F. Wallace as its engineering adviser. The Union Station Company, with an authorized capital of $50,000,000, has been incorporated to maintain a union station for the Chicago, Burlington & Quincy, the Chicago, Milwaukee & St. Paul and the Pennsylvania lines. It is said that $25,000,000 worth of stock will be held by the Pennsylvania and $12,500,000 by each of the other systems. The directors for the first year are Messrs. John J. Mitchell, the Chicago banker; Joseph Wood and J. J. Turner, vice-presidents of the Pennsylvania; Darius Miller, president of the Burlington, and A. J. Earling, president of the St. Paul road. The Union Station Company wants to build a handsome terminal near the present location of the Canal Street Station, but there is great opposition, particularly on the part of the advocates of the "Chicago plan," as it is declared that the great railroad terminals in Chicago should not be allowed to cluster so near the business center of the city. The incorporation fee paid by the Union Station Company was $50,054.

* * *

College Professors Work in Westinghouse Shops.—To obtain practical knowledge of modern engineering methods of manufacture, twenty-eight college professors are spending their vacations working side by side with the skilled mechanics and engineers of the Westinghouse company's East Pittsburgh shops. Twenty-six colleges and universities are represented, the majority being in the South and Middle West. The average length of time these instructors have been engaged in educational work is 5.25 years, and many of them are the heads of their departments. The objects of the educators are fourfold: To obtain a firsthand knowledge of practical electrical engineering; to secure the opinions of successful engineers and manufacturers on the qualifications of men needed in industrial work, so that they may be properly qualified for success in their chosen branches; to exchange teaching ideas among themselves; and to study Pittsburgh's opportunities. The professors are employed on the shop pay-roll and conform to shop hours and regulations, receiving therefor a compensation of 22 cents per hour, or an average of $55 per month; the regular rate for second-year apprentices. In addition to working all day, meetings and shop inspections are scheduled for four evenings each week and trips are made to some industrial plant every Saturday afternoon.

* * *

SOCIETY MEETINGS

Summer Meeting of Wisconsin Electrical Contractors.—The Electrical Contractors' Association of Wisconsin will hold a summer meeting on board the steamship *Georgia* on Lake Michigan, Aug. 7 to 12, during a trip from Milwaukee to Sault Ste. Marie, Mich., and return. No papers have been assigned, but there will doubtless be discussions of general interest to members. Mr. Albert Petermann, 626 Lloyd Street, Milwaukee, is the secretary of the association.

* * *

California Electrical Contractors' Convention.—The California State Association of Electrical Contractors will hold its fourth annual convention at Santa Barbara, Cal., Aug. 13 to 16. The first two days are to be devoted to executive sessions, while the 15th will be given over to open meetings. A picnic and field day will close the convention, Aug. 16, the final feature being a Jovian rejuvenation. Mr. J. C. Rendler, Los Angeles, is president and Mr. W. S. Hanbridge, 1408 Merchants' National Bank Building, is secretary-treasurer.

* * *

Annual Meeting of Public Service Association of Virginia.—The annual meeting of the Public Service Association of Virginia, which is composed of a large number of street railway, electric, gas and water companies, was held at the Hotel Chamberlin, Old Point, Va., on July 18. The object of the meeting was to exchange views on matters pertaining to the operation of public utilities and service to the public in general. Among the subjects of general interest discussed were transportation, pay-as-you-enter cars, and problems of electric central stations as well as those confronting gas companies. The following officers were elected: President, Mr. J. W. Hancock, manager of the Roanoke Railway & Electric Company; first vice-president, Mr. J. F. Rison, president of the Danville Traction & Power Company; second vice-president, Mr. B. B. Ferguson, general manager of the Portsmouth Gas Company; third vice-president, Mr. J. N. Shannahan, manager of the Newport News & Old Point Railway & Electric Company, Hampton; secretary-treasurer, Mr. W. J. Kehl, assistant treasurer, Virginia Railway & Power Company, Richmond.

Central-Station Practice at Waterloo, Iowa

Steam-plant and substation equipment—Station operating records—Underground three-wire, grounded-neutral, delta-connected secondary distribution system in business district

The neighboring cities of Waterloo and Cedar Falls, Iowa, obtain their electrical energy for lighting and industrial purposes from the central station of the Citizens' Gas & Electric Company, whose main generating plant is located on the east bank of the Cedar River, the stream which divides Waterloo into two sections. Electricity is supplied to local Waterloo customers directly from the plant and from two substations, one on each side of the river. Equipment in plant and substations is of the most modern type, while in the business district the former overhead construction has been replaced with an underground distribution system to which customers' services are being cut over as fast as practicable. This underground system represents a departure from usual practice in that the lighting and motor loads are supplied from a three-wire, grounded-neutral, delta-connected secondary system, the details of which will be found in the following columns. During the last ten years, the maximum monthly output of the Waterloo central station has increased from 45,000 kw-hr. to 595,000 kw-hr. An unusually smooth load curve is maintained from 7 a. m. until 10 p. m., dropping off only at noon and between factory shutdown and the beginning of the evening lighting load. Accompanying curves show the characteristic daily load of the station, the daily output for one month, and the growth of the electrical business in Waterloo since 1902. The local load includes a large rating in motors which brings the demand during daylight hours above even that due to the evening lighting service. Herewith are given tabulated data on the rating per capita, annual load factor and income on investment of this company taken from the report submitted by the committee on central-station facts and factors at the Iowa Electrical Association convention recently held in Waterloo.

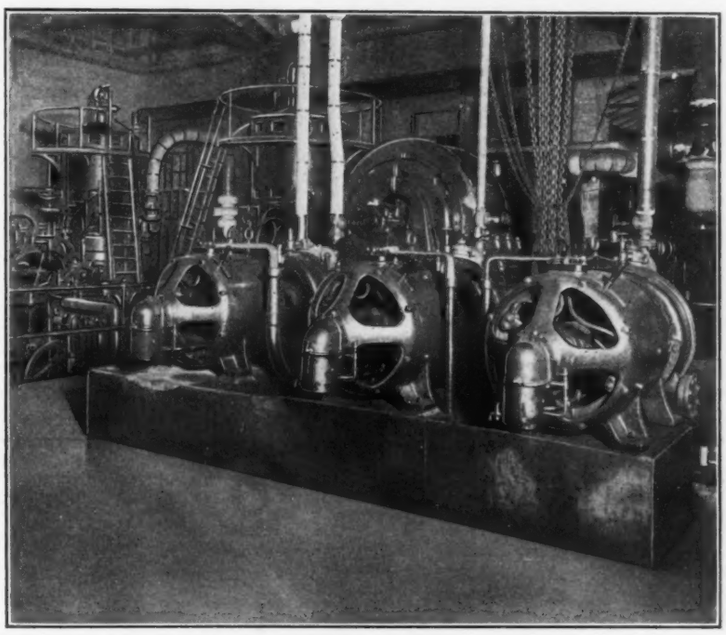


FIG. 1—EXCITERS AND TURBINES AT WATERLOO, IOWA

As already mentioned, electricity is distributed to Waterloo consumers from the main generating station and from two substations situated about a mile and a quarter from the main station. The generating plant and one of the substations is located on the east bank of the Cedar River, while the other substation is on the west side of the river. Although the plant building is not itself new, the generating and switchboard equipment it contains is of the most modern type. The substations have just been completed during the past year and are duplicates of each other.

In the main generating station are six Lyons boilers and two Babcock & Wilcox boilers. The Lyons boilers are of the combination fire-tube and water-tube type, with reversed circulation. Two 400-hp Lyons boilers are equipped with steam-driven Green chain grates, each having 80 sq. ft. of area. The combustion chambers are provided with flat arches located 13 in. above the grate. Iowa coal containing from 20 to 28 per cent ash is burned beneath these boilers. The remaining units which consist of two 400-hp, one 200-hp and one 300-hp Lyons boilers, and two 170-hp Babcock & Wilcox boilers are hand-fired and burn Illinois coal which contains 11 to 13 per cent ash. It is possible to run these boilers at 25 per cent continuous overload and at 50 per cent overload for short periods. The settings for these steam-generating units are of brick, individual mountings being provided. Draft is supplied by a 135-ft. stack.

Each boiler is provided with two safety valves connected on a T, as an additional precaution. The automatic stoker-fired boilers are equipped with Lunkenheimer non-return stop valves, which prevent the whole supply of steam from the main headers blowing back into a boiler in case a tube breaks. To prevent unburned coal being carried under the bridge wall and dumped in the ash pit, those boilers provided with chain grates are equipped with 4-in. high-pressure water backs. The other boilers are fitted with 4-in. low-pressure water backs.

The boilers are carried in separate brick settings and deliver steam to a 10-in. header at the rear of the banks. The main header is supported on brick pedestals 6 ft. above the floor. Beneath the header at each point where a steam pipe from a boiler taps the header is a drip-pocket and a trap. All steam and feed-water pipes are covered to prevent radiation of heat.

Natural draft is maintained under the boilers by a Weber concrete smoke stack which is 90 in. in diameter at the top, and 135 ft. high measured from the grate level. Feed water is heated in both open and closed type heaters, the condensate from which is trapped and returned to the boilers. The inclosed heaters receive exhaust steam from the turbo-exciters and the open type are supplied with the exhaust from the reciprocating auxiliaries. All of the feed water supplied to the boilers is measured by a 4-in. Venturi meter which shows momentary supply, integrates the total, and records these quantities on a chart.

As Iowa and Illinois coal are used in different boilers the fuel supplies are kept separate. An elevated track runs parallel with the boiler settings and the coal cars dump their supply into concrete bunkers, the floors of which are on a level with the firing aisle. From here it is delivered to the respective boilers after being weighed.

The generating equipment comprises two two-stage 750-

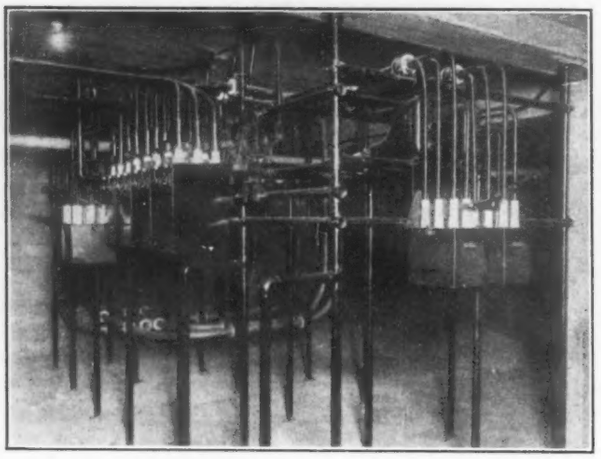


FIG. 2—CABLE AND OIL-SWITCH RACK IN SUBSTATION

kw vertical turbo-units rated at 80 per cent power-factor and one five-stage 1250-kva horizontal turbo-unit. All of the generators are General Electric machines, and furnish three-phase, 60-cycle electricity at 2300 volts when operating at 1800 r.p.m. Exciting energy for the alternators is supplied by three 25-kw General Electric 120-volt generators which operate at 3750 r.p.m. The exciters are connected to a common bus and arranged to equalize the load when one machine is cut in or out of service.

An accompanying illustration presents a view of the generating room showing three turbo-exciters in the foreground and two vertical and one horizontal turbo-alternators in the background.

Wheeler surface condensers are used on all of the generating units except the exciter sets which run non-condensing. Auxiliaries, such as vacuum pumps, are driven in some cases by steam and in other cases by electricity. This mixture of steam and electric drive is employed so that there will be no more exhaust steam that can be utilized in the feed-water heaters.

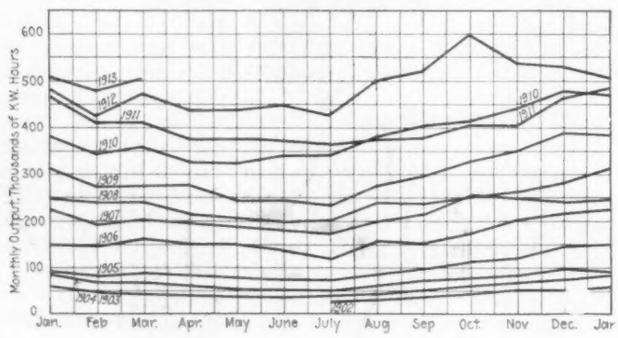


FIG. 3—CURVES SHOWING OUTPUT OF STATION FROM 1902 TO 1913

Between the turbines and their respective condensers are gate valves which can be opened allowing the machine to exhaust directly into the atmosphere in case the condensers fail to work. This arrangement avoids the heating of the condensers in case the cooling water has to be shut off. The gate valve on the 1250-kva unit is interchangeably operated by motor or by hand. The motor is a 1.5-hp, 115-volt series machine and is geared to the rod operating the gate valve.

On occasions when the power-factor is poor, and all of

STATISTICS CONCERNING CITIZENS' GAS & ELECTRIC COMPANY, WATERLOO, IA.

Population served	38,000
Consumers per 100 population	10.8
Rating of station in kw at 80% power factor	2,200
Watts per capita	59
Kw per employee	78.5
Ratio station rating to connected load in per cent	28.4
Average load, in kw	661
Ratio average load to station rating in per cent	30
Annual load factor, per cent	31.6
Investment per kw rating	$500
Investment per capita	$29
Gross annual income per kw rating	$104.70
Gross annual income per customer	$56.20
Gross annual income per capita	$6.06
Gross annual income per $100 invested	$20.95
Gross annual income per kw-hr made	$4.00
Ratio of operating expense to gross income in per cent, not including overhead charges	47.8
Net earning per $100 invested	$8.91
Hours in operation per year	8,760

the generators are not running, the output of the station is increased without additional steam consumption by floating one of the generators on the line as a synchronous

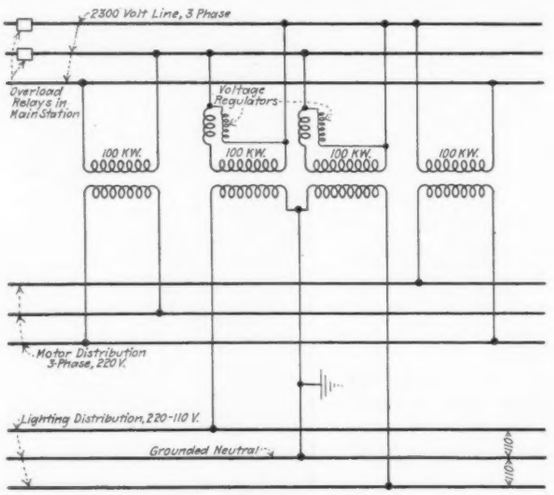


FIG. 4—CONNECTION OF TRANSFORMER BANK TO UNDERGROUND SYSTEM

motor. Steam is bled into the turbine of the machine operating as a motor so that the blades will not become excessively heated.

Air for cooling the horizontal turbine-unit is drawn in from the outside through cloth screens. These are arranged so as to give as large a surface as possible for the inlet of the air, without taking up much room. The cloth is replaced once a month.

Switchboard in Main Station

The switchboard has been systematically and carefully arranged so that all parts are readily accessible for inspection and repair. The board consists of the customary machine, exciter, meter and distributing panels and in addition an arc-lamp panel for city lighting and four underground distributing panels installed recently. One of our illustrations gives a view of the switchboard, showing the underground distributing panels in the foreground, the oil switches and disconnect switches behind the board on racks, and the voltage regulators on the gallery over the switchboard.

One Tirrill voltage regulator is used to control all of the generators in parallel as it has been found difficult to

maintain uniform voltage on all of the machines with separate regulators. The roll of paper on which the recording wattmeter traces its curve is used for several years in succession for comparative information. As single-phase lighting circuits are employed, each lighting distribution panel is equipped with two oil swtches in order that the energy may be taken from the least loaded phase of the three-phase system. Each motor and lighting panel is equipped with relays which operate voltage regulators on that particular line.

The underground-system distributing panels are similarly equipped with meters, carrying also the oil-switch handles, voltage-regulator relays and overload relays. Each panel is equipped with two overload relays connected so as to protect the generators against grounds of any kind on the lighting and motor systems. An inspection of the wiring diagram shows how the overload protection is maintained at the main station and how the transformers at the substations are connected so as to furnish energy to the motors and lamps. This diagram does not include the voltage regulators which are installed at the main station.

In case the relays fail to control the voltage regulators for the underground 2300-volt distributing system, a lever

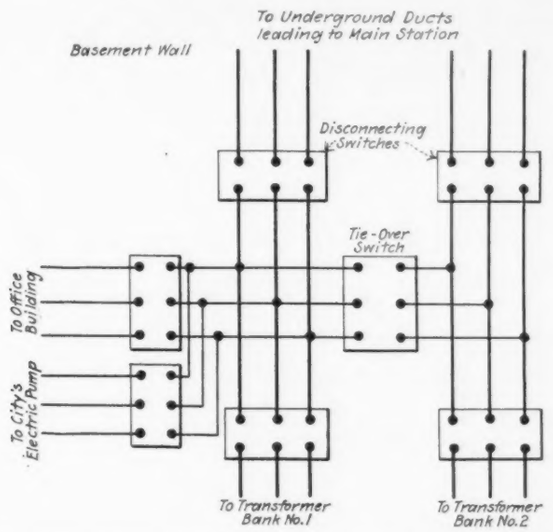


FIG. 5—CONNECTIONS OF UNDERGROUND CABLES TO SUBSTATION OIL SWITCHES

on the face of each panel can be manipulated by hand to operate the voltage regulator motors.

Behind the switchboard, but removed from it sufficiently to permit a person to inspect the back of the board, is a rack made of iron pipes upon which the oil switches are supported. Above each oil switch is a three-blade disconnect switch. The high-tension busbars are supported on insulators on top of the rack. The oil switches are all mechanically connected to the oil-switch handles located on the panels by rods running beneath the floor.

On the gallery above the switchboard are located four Westinghouse inductive-type voltage regulators which compensate for line drop on the underground system. In addition to these there are General Electric potential regulators on each of the five remaining lighting panels. These can be operated by hand if desired by turning a dial on the face of the panel. Any desired voltage can be maintained at the center of distribution by this method without having different voltage buses on which to connect the different feeder circuits.

Three wires from the 2300-volt busbars connect with an aluminum-cell lightning arrester located on this gallery. The usual equipment for charging the aluminum cells, together with the horn-gap arrester, is also located in the gallery. At one end of the gallery over the machine panels are three General Electric generator-field rheostats which are operated by a solenoid and ratchet attachment.

Fuses for the voltage-regulator motors on the underground system are inclosed in a steel cabinet fastened to the brick wall at the rear of the switchboard. All other motors used in or about the station are provided with special cir-

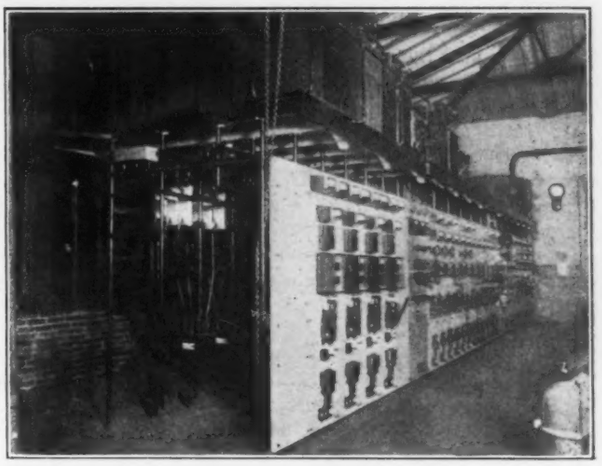


FIG. 6—MAIN SWITCHBOARD

cuits and fuses located in a separate panel box. A special bank of transformers supplies energy to lamps used for the station lighting. A three-blade double-throw switch installed in a special panel box may be used for transferring this lighting circuit onto the exciter busbars in case the 2300-volt system fails.

Since the city of Cedar Falls also receives its supply of electricity from Waterloo, a bank of three 75-kw General Electric transformers is installed in a room opening onto the main floor of the generating room. These transformers step the pressure from 2300 volts up to 10,500 volts. There are no disconnect switches on the Waterloo end of the 10,500-volt line, the oil switches being connected in the 2300-volt leads. The energy supplied to Cedar Falls is recorded on a separate panel from the rest of the energy generated.

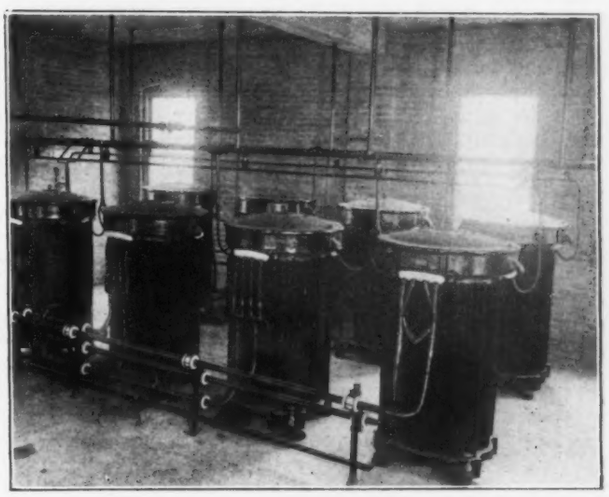


FIG. 7—SUBSTATION TRANSFORMER INSTALLATION

A reproduction of the station log chart is shown herewith. It was designed especially for this company and is laid out so that when filed in a loose-leaf binder, comparisons can easily be made with any other date. By referring to this chart, weather conditions, period during which men are on duty, meter readings on electrical and steam appa-

ratus, and other information is readily available. Space has been left at the bottom of the chart for plotting a curve showing the varying total kilowatt reading. On the reverse side of the sheet spaces are divided off in which curves are plotted showing the variation in current readings.

The cables which feed overhead lines in the city of Waterloo are carried up the wall back of the switchboard through conduit and run to the lightning arrester gallery, which is located at one end of the building under a cupola through which the cables are conducted outside. Choke coils and multiple-gap lighting arresters are located in this gallery.

In each substation cables run from the disconnect switches to separate transformer oil switches, which are connected with two banks of delta-connected transformers located on the second floor. The transformer banks can be operated separately or in parallel by closing a tie-over switch. Oil switches are connected in between the 2300-volt cables and two other circuits supplying one of the city's electric pumping stations and a motor-generator set located in an office building. The disconnect switches and the two last-named switches can be operated by hand only in the basement. The remaining switches are connected mechanically to switch handles on first-floor panels.

On the main floor is a six-panel switchboard and a 50-

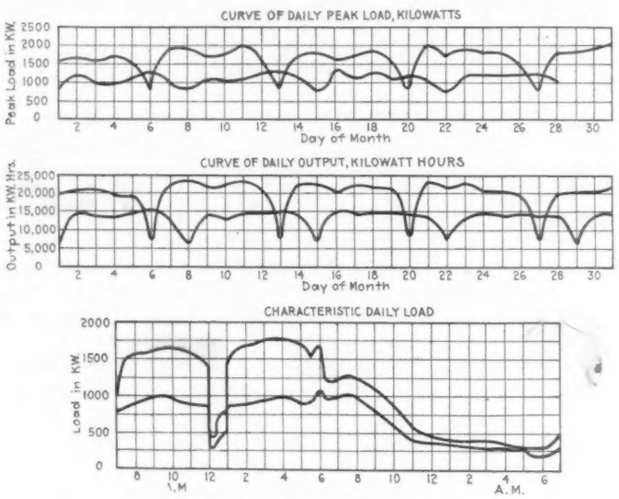


FIG. 8—CHARACTERISTIC LOAD CURVE

amp mercury-arc rectifier which is used in charging the company's automobiles. Two of the panels are equipped with apparatus controlling the 2300-volt circuits entering the station. The low-tension light and motor circuits are controlled on two other panels which are equipped with meters, switches, tie switches, etc.

Cables are brought from the oil switches in the basement through conduit to the second floor. Here they are run horizontally over the transformer banks and are supported on insulators secured to overhead racks. Each transformer bank consists of four 100-kva, oil-cooled General Electric transformers. The primary winding of two of the transformers are connected in parallel across one phase of the 2300-volt circuit and the two remaining transformers are connected in delta with them. The secondaries of the first two transformers mentioned are connected in series so as to give 220 volts across the extreme terminals, and a neutral tap taken out between them for lighting.

The secondary terminals from the transformers are connected to low-tension busbars consisting of 1.25-in. copper tubing which is run down the wall back of the switchboard on the first floor. The copper tubing connects to copper pot-heads sweated on cables which connect with the switchboard busbars.

At present five three-conductor low-tension cables run out of the substation described through the basement wall into a distributing manhole. For lighting service a grounded neutral is used. From the substation under consideration, two grounded neutrals extend in each direction; one has a cross-section of 1,500,000 circ. mil and the other has an area of 500,000 circ. mil. The other substation has two 1,000,000-circ. mill grounded neutrals.

The grounded-neutral three-wire system shown herewith

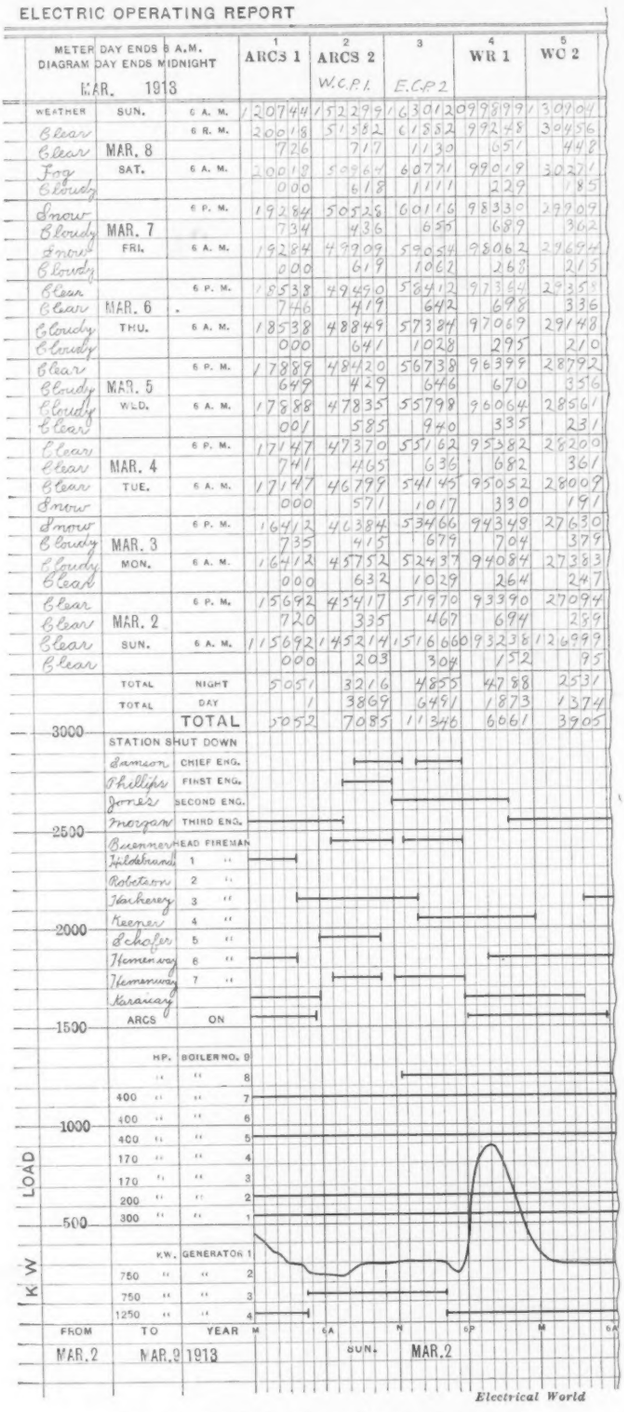


FIG. 9—SECTION OF LOOSE-LEAF RECORD

was designed by Mr. Austin Burt, manager of the Citizens' Gas & Electric Company, of Waterloo. Mr. Burt plans to deliver a technical paper on the vector analysis of such a system before the American Institute of Electrical Engineers at some future meeting. The regulators placed as shown in the diagram permit of considerable unbalancing of the system without unsatisfactory voltage conditions.

Water Sterilization by Ultra-Violet Rays

BY DR. MAX VON RECKLINGHAUSEN

In Europe the ultra-violet rays are now being used industrially for the sterilization of water by the system which is based on the experiments made jointly by the writer with Messrs. Henri and Helbronner at the Sorbonne University, Paris, as described in the *Electrical World*, on April 6 and Dec. 30, 1911. It may be well to mention briefly the main principles embodied in these types of apparatus. The first requirement is that water free from suspended matter—that is to say, properly filtered water—be exposed as close as possible to a mercury-vapor quartz-tube lamp which is kept running at a high temperature, thereby producing economically ultra-violet rays in great quantity. To maintain this high temperature the apparatus must be so constructed that the water does not touch the source of light itself. In the first apparatus described the water flowed underneath the lamp, while in the large apparatus it passed successsively under four lamps. This principle is still applied in the industrial water sterilizer shown in Fig. 1, where the water circulates in an undulating fashion within a cone of light produced by a 110-volt, 3.5-amp quartz-tube lamp. Such apparatus has been in constant use in Europe for several years.

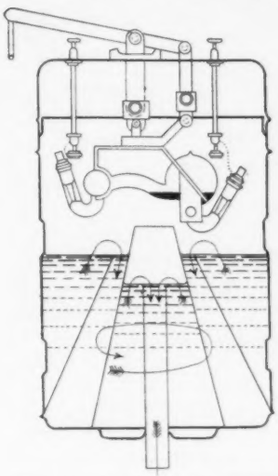


FIG. 1—APPARATUS WITH WATER BENEATH LAMP

This type of apparatus is being utilized by the army for field work. As indicated in Fig. 2, in this case it is placed on an artillery cariage, together with the necessary water pump, filter, gasoline motor-generator set, etc. Such a set makes use of any kind of river or spring water and produces therefrom safe drinking water for the troops in the field, combating thereby an enemy far more dangerous than the opposing army.

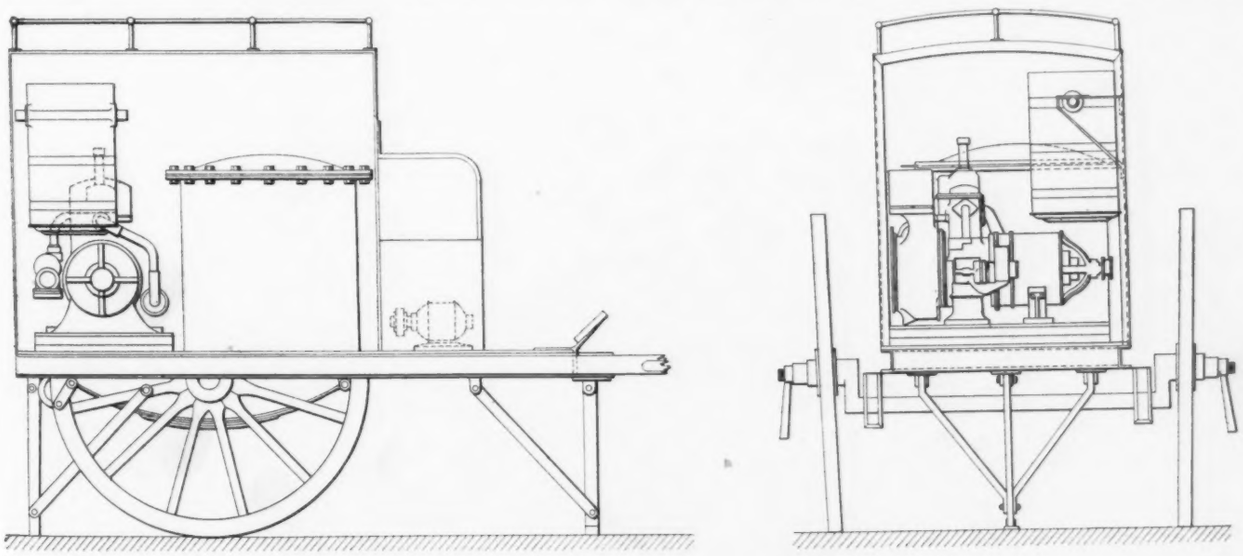


FIG. 2—TYPE OF EQUIPMENT USED IN ARMY AND FIELD SERVICE

Installations of apparatus for large masses of water using a 220-volt, 3.5-amp lamp inclosed in a box fitted with quartz windows have now been in service in several cities in Europe, some even more than two years and a half, and have constantly done their bactericidal work in such a satisfactory manner that the writer was soon led to study the construction of larger units. An important element for such larger units was a more powerful quartz-tube mercury-vapor lamp. In making such a new lamp an effort was made to follow as closely as possible the practice previously established for the illuminating quartz-tube lamps regarding the proper temperature of the electrodes and of the luminous tube and the density of the vapor. It was considered desirable to avoid increasing the diameter of the luminous tube because among other difficulties trouble was foreseen in the regular manufacture of large quartz tubing. It was decided to utilize the same diameter of tubes and practically the same type of electrodes, increasing only the length of the lamp and therewith its operating voltage. The largest type of these new lamps now in service are used on a 500-volt circuit, operating with about 3 amp and 375 volts at the electrodes.

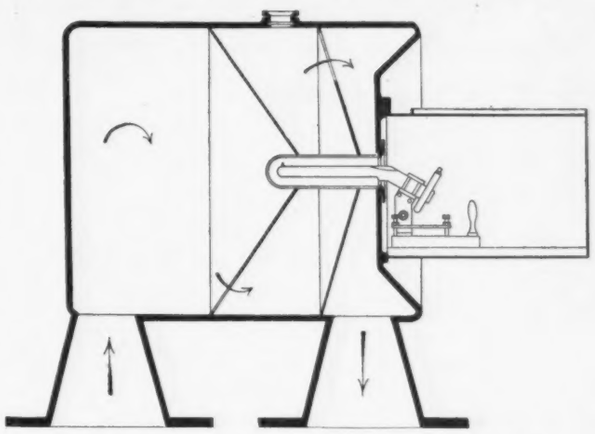
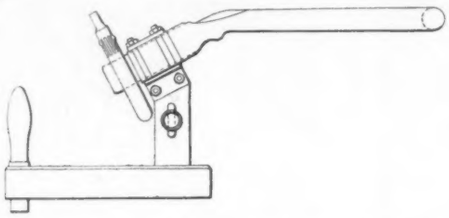


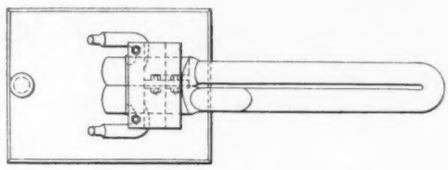
FIG. 3—SMALL UNIT FOR CITY-WATER STERILIZER

The most important change in connection with these new lamps has been in the shape of the luminous tube, which is not straight but U-shaped, the two branches being kept very close together. When viewed from the side in cross-section, as indicated in Fig. 4, such a lamp resembles more or less a pistol, and this name has been adopted for this type of the lamp. The reason for giving to the luminous tube of these "pistol" lamps the shape described above is to be able so to construct the sterilizing apparatus that practically all of the light given out by the tube is utilized. In

the earlier type of apparatus only about 60 per cent of the light entered the water. The peculiar shape of the luminous part of the pistol lamps permits it to be inserted completely in a small cylindrical space, all the bulky parts of the lamp being only on one side and producing practically no shadow.

The lamps are started as heretofore by tilting. However, the lamp is removed from the cylinder and started in a kind of a box fitted with a dark glass window which protects the operator. After lighting, the lamp is placed in the protecting cylinder, which itself is a quartz tube about 2 in. in diameter. This quartz tube successfully protects the lamp from contact with the water. The lamp box and the 2-in. quartz tube are fastened to a vertical metal plate, which plate itself forms one of the walls of the sterilizing chamber or is inserted into the wall of the water chamber or canal.





FIGS. 4 AND 5—A CROSS-SECTION AND TOP VIEW OF THE U-TUBE LAMP

The ultra-violet efficiency of these lamps has been determined very closely by means of sterilizing and chemical tests and also by the effect on photographic paper. All these tests show this lamp to be much superior to the lamps formerly used, the improvement being far more than one would expect from the proportionate increase in the power consumption. For example, the ultra-violet production measured as above is fifty times as great as that of a 110-volt, 3.5-amp lamp, although the ratio of power consumption is only about four to one. This result is probably due to the mutual heating effect of the neighboring branches of the U-shaped luminous tube. Such lamps have been in service in a large European water plant for nearly a year and have given excellent satisfaction as to life and efficiency.

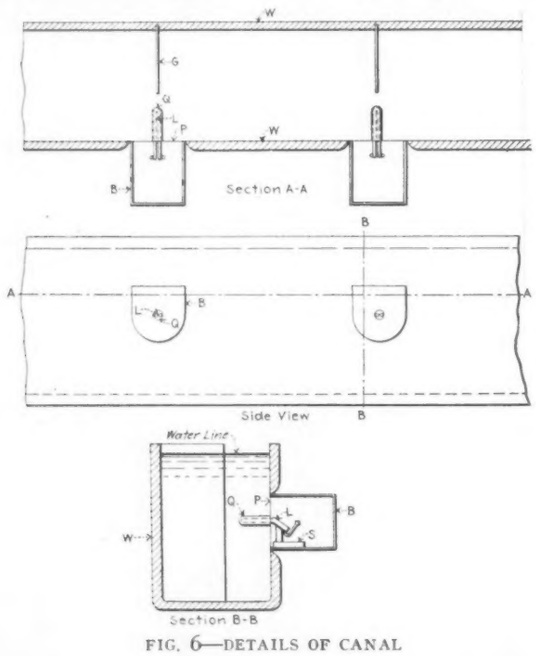


FIG. 6—DETAILS OF CANAL

For small units for city water sterilizers—that is, from 500 to 2000 tons of water per twenty-four hours—only one or two such 500-volt lamps, constructed according to Fig. 3, are used. For larger water quantity use is made of a multiple unit consisting of a canal (Fig. 6) about 50 in. by 70 in. in cross-section through which the water flows. The canal is made of metal or else of reinforced concrete and coated with tiles inside. Into the walls of this canal are inserted ten or twelve of the above-mentioned 500-volt pistol lamp equipments, baffle plates of glass being inserted into the walls of the canal at proper places so as to keep the water continually stirred up while under the influence of the light. An electric water valve held open by the electric current used in all or some of the lamps allows the water to pass through this canal only when the lamps are in service, insuring thereby that no unsterilized water leaves the canal. For several minutes the water in such a canal is under the influence of the ultra-violet rays, although theorectically an exposure of infinitely less duration would be sufficient—such as a fraction of a second within 1 in. of the lamp. However, the writer prefers a longer exposure so as to allow time for turning over and over under the light any microscopic particles passing through the filters, behind which microbes might be hidden.

A canal of this type with twelve lamps has been in continuous operation for eight months in a municipal water plant in Europe. The water, which flows at a rate of from 7500 to 8000 tons per twenty-four hours from a river, is first cleared by a sand filtration plant. As will be seen the whole arrangement is extremely simple, and practice has shown that the apparatus needs scarcely any attendance. During most of the time only a part of the lamps are in service, all being used simultaneously only in case the water is extremely dark. For large water plants the best plan is to make use of a number of such canal units.

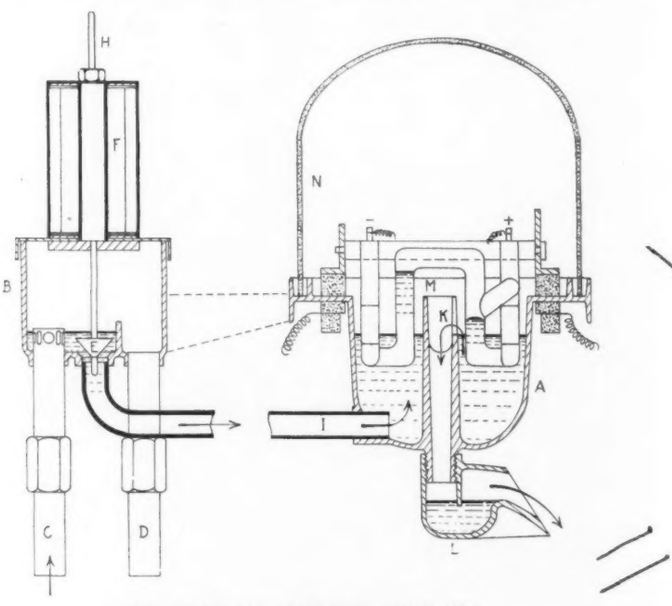


FIG. 7—SMALL DOMESTIC STERILIZER

Regarding smaller apparatus the most recent development is the small domestic sterilizer shown in Fig. 7. To promote simplicity in this type of apparatus it was thought desir-

able to minimize the complications of the quartz-tube lamp itself. The lamp consists of an ordinary U-tube, the necessary cooling of the electrodes being done by inserting the mercury containers partly into the water which is to be sterilized, there being, however, no contact of the water with the luminous tube itself. This procedure eliminates the necessity of condensing chambers and enlarged electrodes. It is naturally important that the water level in this apparatus should not change during operation. This result is obtained by means of large overflows indicated on the design. This apparatus is designed to produce up to 20 gal. of sterile water an hour. The lamp consumes about 2 amp on a 110-volt direct-current system.

In conclusion it may be stated that experience shows that any water can be sterilized by ultra-violet rays if it is free from suspended matter. The only difficulties encountered in practice have been attributable to such suspended materials which escaped the rather superficial inspection of the water. Whenever a careful observation does not disclose any suspended matter one can be sure that the water is economically sterilized by ultra-violet rays, the economy depending upon the transparency to ultra-violet rays of the particular kind of water. The transparency can easily be determined by comparing the actinic effect from a quartz lamp on photograph paper through a column of air and the water being examined.

Canadian Electrical Association Papers

In the issues of the *Electrical World* for July 5 and July 12 an account of the convention held at Toronto on June 25 to 27 were given. Below are to be found abstracts of papers and discussions relating to graphic meters, integrating wattmeters with recording attachments, magnetite arc lighting, flame carbon arc lamps and electric vehicles.

Magnetite Street Lighting

Mr. L. Burpee, of the Canadian General Electric Company, in a paper on "Magnetite Street Lighting," traced the development of the arc-lighting industry from the old direct-current arc lamp to the present luminous arcs. He also compared the power consumption and life of the various types of arc lamps, showing that while the 6.6-amp magnetite lamp has an energy consumption only slightly greater than that of the open-arc lamp, its specific consumption is 0.38 watt per hemispherical candle-power as compared to 0.59 in the case of the open-arc lamp. Speaking on the subject of ornamental street lighting, the author said that for some years back the desire, especially in congested thoroughfares and on residential streets and parkways, for ornamental lighting was first met by tungsten clusters on ornamental standards spaced about 75 ft. apart on both sides of the street, but, owing to the fact that the efficiency of this system was very low and maintenance and operating charges high, the magnetite lamp has been adopted for ornamental lighting within the last two years, with excellent results. He rehearsed all the advantages of the ornamental luminous-arc standards for downtown, residential and parkway lighting, describing the lamps and rectifier outfits for such systems. Lantern slides were also thrown on the screen showing the magnetite arc installations in New Haven, Utica, Baltimore, Calgary and Edmonton.

Flame Carbon Arc Lamps

The long-hour series alternating-current flame carbon arc lamp of the Westinghouse Electric & Manufacturing Company was described by Mr. T. J. Pace, of that company, and its advantages and applications were pointed out. One of the most interesting applications in this particular form of lamps is to low-frequency circuits of 25 cycles. Since the light of an unimpregnated carbon arc is emitted from the positive crater, the source shifts continually from upper to lower electrode with each reversal, and as this results in giving alternately a downward and an upward illumination, the light variation at this low frequency is very marked. In the flame or impregnated carbon arc the light is obtained from the arc screen and is therefore independent of the polarity. There is, of course, a slight decrease of light at each reversal of current due to cooling of the arc gases. This, however, is not considered objectionable in industrial plants where the need of the work does not require accuracy of vision. The author predicted that the long-burning flame carbon lamp will be more freely used in the future on low-frequency circuits for street lighting than at present. Stereopticon slides were shown of street lighting in some Pennsylvania towns and also of the illumination of the Baltimore armory during the Democratic convention in that city last year.

The papers on luminous-arc lamps were discussed in common, Messrs. A. L. Mudge, of the Electric Power Company, Ltd., of Toronto; H. W. Hillman, of the General Vehicle Company, Long Island City, N. Y.; Wills Maclachlan, of the Trenton Electric & Water Company, Belleville, and Messrs. Howell and Hastings, of Toronto, participating. Mr. Mudge said that the five-lamp tungsten clusters were not so good as the magnetite arc for the business sections of cities and that in Calgary, where the magnetite lamps are mounted on the trolley posts on both sides of the street about 18 ft. from the ground, good results are obtained. Magnetite arcs are installed on Eighth Avenue, whereas tungsten clusters are to be found on Seventh Avenue in Calgary, so that a comparison of both systems can easily be made. In the residence section of Calgary the magnetites are widely spaced on high standards, but give good results owing to the fact that there are no trees on the streets of Calgary. Mr. Hillman told of the development of the magnetite-arc lamp, work on which was started fourteen years ago. The lamps, however, were not placed on the market until fully developed. Mr. Maclachlan said an excellent impression of the relative merits of the tungsten cluster and the magnetite standard could be had from the square at the junction of Main and Genesee Streets in Buffalo looking toward the Buffalo General Electric Company's new building. On the street the right magnetite arcs are installed, while the street leading off to the left is equipped with tungsten standards. Mr. Howell questioned the advisability of installing magnetite lamps in residential sections where the light would enter the sleeping rooms on the upper floors. It was pointed out also during the discussion, in answer to a question, that rectifiers operating on 25-cycle circuits gave a frequency of 50 on the direct-current side. This is obtained by intermixing the two parts of the secondary coil.

Graphic Meters

Mr. G. D. Gratton, of the Electric Power Company, Ltd., of Toronto, gave a review of the experience and methods followed by his company with graphic meters. After stating the general principles of the measuring element of graphic meters, the author said that the selection of any particular meter depends on several conditions, such as the nature of the load, the terms of the contract and the accuracy by which the load must be measured. If the charges are based on the indications of the meter, it is important that it should be accurate even if accuracy can only be obtained at great cost, while, on the other hand, if the meter is merely intended to show the nature of the load, a cheaper instrument will suffice. The speed at which the paper should travel is also determined by the character of the load to be measured and the duration of the peak, especially in the case of graphic wattmeters. For instance, on a light load, with a slow rising and falling peak and generally a peak of rather long duration, a paper speed of 1 in. per hour may be used with good results. On the other hand, with a motor load comprising mill machinery, such

as rock crushers, air compressors, pulp grinders, etc., where the load is fluctuating and the peaks are of short duration, if a high speed is used the curve will be extended and the intervals between the peaks plainly distinguished. For a one-minute peak a chart speed of not less than 4 in. an hour should be used, but in general a chart speed of 1.5 in. or 2 in. an hour will suit the majority of cases and will permit a peak of short duration (not less than five minutes) to be scaled with accuracy. Moreover, a meter with a fairly wide chart is better adapted to accurate reading than one using a narrow chart, especially in the case of large wattmeters and ammeters. According to the author, the scale of a graphic meter should be so chosen that with the average working position of the pointer it will be at least half-way across the chart. This tends to accuracy in reading and in the case of an alternating wattmeter will permit it to operate on the load with a lower power-factor without overloading the series windings and still keep the pointer well up on the scale. On the question of repairs and maintenance the author was particular to state that, inasmuch as a large portion of the work is light and delicate, repairs should not be attempted by anyone who has not had previous experience in such work. He also stated that it is very poor policy to buy a graphic meter, which while low in first cost is constantly in need of repairs. The cost of doing various kinds of repairs (labor only) as found by the writer is as follows: Hand-wound clocks, $1.60 to $4, average $2; motor-wound clocks, $0.75 to $3.50, average $2; clock motor, $2; paper mechanism, $2 to $6.50; replacing pivot, $1.80; repairs to pen, $1 to $2, average $1.80; dotting mechanism, $1.50 to $4, average $2; pen-lifting mechanism, $1.50; pen-shaft bearings, $1; cleaning jewels and contact points, $2; repairing resistances, $5; repairing control circuit, $2.

After giving some information on shop testing and testing in service, the author accentuated the following points which should receive consideration when deciding on the purchase of a graphic wattmeter: (1) Size of the contracted load and the possibility of a quick increase; (2) the kind of load, whether steady or intermittent; (3) the power-factor of the load; (4) the length of the contract peak and its relation to the actual peak (this is in order to determine the correct chart speed); (5) the maximum fluctuations of the load or the average fluctuations.

Integrating Wattmeters with Recording Attachments

Mr. H. S. Baker, of the Ontario Power Company, Niagara Falls, Ont., in a paper described a form of integrating demand meter developed by Messrs. S. Piek and R. C. Downing, of the Niagara, Lockport & Ontario Power Company, which graphically registers integrations of power during intervals of one minute or longer. A Westinghouse watt-hour measuring element is used and the clutch device which operates the recording mechanism is upon a shaft which rotates once for every hundred revolutions of the meter shaft. On the clutch shaft an electrically released clutch is mounted which remains closed for an interval of one minute. A contact operated by clockwork mechanism serves to disengage the clutch so that it can be pulled back to zero position by a spring. The opening of the clutch contact allows the clutch to close and be driven for another minute by the watt-hour element. Upon the driven half of the clutch is an arm which engages a pen mechanism so arranged that the linear deflection of the pen in a direction at right angles to the travel of the paper is proportional to the number of revolutions of the clutch which engages the recording element with the rotating spindle of the watt-hour meter. The deflection of the pen at the expiration of the time element selected for the measurement of the demand measures the kilowatt-hours consumed. Instead of entirely resetting the pen at the expiration of each such period to the zero position, the pen is only partially returned, but is reset to zero or near it every six hours by a separate electromagnet energized through a corresponding six-hour contact on the clock. The chart in these meters is registered on a strip of paper 5½ in. wide and 45 ft. long passing through the meter at the rate of 1 ft. a day. The paper has only one line on it—namely, the zero line—and is pulled through the meter between rubber rolls. The deflections are measured both in calibrating and in billing from the top edge of the zero line to the top edge of the ink line drawn by the pen. The one-minute integrating peak of power is represented by the momentary peak on the chart, which is not affected by paper speed. The clock is wound electrically from the potential circuit feeding the meter or some other potential circuit every 14.4 minutes, but a no-voltage release is provided which connects the clock winder to a set of dry cells whenever the voltage fails owing to customers' switching or otherwise. Another no-voltage release is provided which closes a contact that operates the clutch magnet as soon as voltage is again established, thus avoiding the registering of a fraction of a minute of power before shut-down plus another fraction after starting up, which might amount to nearly two minutes of power. The following advantages are claimed for the meter: (1) Reduced interruptions to meter chart due to clock and pen trouble; (2) increased permanency of calibration; (3) increased accuracy in reading of peaks on account of peaks on chart being definite; (4) reduced maintenance expenses; (5) determination of peaks on kilowatt-hour basis.

Discussion

Both of the foregoing papers were discussed at the same time, Messrs. R. J. Smith, of the Canadian Electric & Water Power Company, Perth; H. S. Baker, of the Ontario Power Company, Niagara Falls; C. G. Keyes, of the Ottawa Electric Company, and A. A. Dion, of the Ottawa Electric Company, participating.

The Electric Vehicle

In a paper on "The Electric Vehicle," prepared by Mr. Stephen G. Thompson, of the Electric Vehicle Association of America, it was pointed out that, although there is ample field for the use of the electric pleasure machine, the probabilities of its wide general adoption are remote. On the other hand, visible evidence of the possibilities of electric commercial vehicle application is apparent on the slightest investigation. The author pointed out that with those concerns of whose business a considerable part is teaming or delivering electric trucks find special favor. The field of application of the gasoline machine is not generally found within city limits. Stops and starts reduce its average speed to a point below that of the electric vehicle, and the total running time possible in a full day's operation is not sufficient to allow a mileage radius beyond that of the electric. Paradoxical though it may seem, an electric machine of moderate speed capacity will move faster in city streets and where the stops are numerous than will the higher speed gasoline truck. The author proved this point by tests which showed that an electric vehicle possessed a general average speed nearly 10 per cent greater than that of a gasoline machine, notwithstanding the fact that the latter was geared to a speed 50 per cent higher. Data on the operating costs of motor vehicles in several similar lines of business also disclosed the fact that for the electric vehicle the average cost per mile for maintenance increased only 13⅓ per cent for a period of four years, while that of the gasoline machine increased 362.5 per cent in the same time, and further at the end of the four-year period the maintenance cost for the electric vehicle was less than 50 per cent of that of the gasoline. These figures, representing fifty-four gasoline and sixty-nine electric machines, were obtained from the records of the operators themselves and included all items chargeable to the replacement of mechanical apparatus, storage batteries and tires. The reason for

the disparity is found in the simplicity of construction and design of the electric. Moreover, because of the characteristics of the motor, the electric machine is not subjected to the abuses of an unskilled operator, so that the machine is seldom out of service for any extended time. Considering the increased high average speed of operation and the decreased operating cost, the author said it is no wonder that nearly all of the large vehicle installations are of the electric type and that less than ten active electric vehicle manufacturers are marketing over 20 per cent of the total number of commercial motor vehicles employed, in competition with over 300 manufacturers of gasoline trucks.

ELECTRIC VEHICLES FROM THE CENTRAL-STATION POINT OF VIEW

Mr. C. Rummel, of the British Columbia Electric Railway Company, Vancouver, B. C., in a paper treating the electric vehicle from the central-station point of view, stated that his company found that the practice of selling vehicles through combination agents did not result satisfactorily to its interest in connection with the sale of electric cars of the commercial type. As a result of these conditions, the company this year decided to take an agency, enter the selling field and make a genuine effort to introduce electric commercial cars within its territory. The company purchased three electric trucks last year for its own work, and on the basis of the good showing made by the few trucks in use in Vancouver it felt that vigorous efforts should be made to introduce the electric commercial vehicle, although it then still preferred to leave the matter in the hands of the agents, provided the business was properly pushed and adequate garages were afforded. Upon canvassing the agents the outlook was far from encouraging, so that the company decided to take up the matter itself. At the very outset it engaged an electric-vehicle expert of eleven years' practical experience both in selling and garaging. This man received the advantage of extensive advertising in the daily press, thus thoroughly acquainting merchants with the advantages of electric trucks as well as the entrance of the company into the business. The salesman began his campaign among the wholesale merchants on Feb. 15, and a very effective method followed was to offer the service of one of the company's trucks to reliable merchants for an ordinary day's delivery. Since the campaign began the company has sold a 2-ton truck to a wholesale fruit merchant, a 2-ton truck to a wholesale hardware firm and a 1-ton truck for a hotel bus. During the period the company has also found use for two 2-ton trucks, which have replaced a gasoline truck and a horse-drawn wagon, and a business electric vehicle for the light and power department. In addition to the company's orders there have been sold to Vancouver firms through outside agents a 2-ton truck of the electric type to a milling firm and a 750-lb. delivery rig to a local fish merchant. The company generally orders the chassis only, the bodies and tops being built in the city to suit the purchaser. This plan is necessary owing to the duty on cars imported from the United States. A garage is now being built in the center of the city and a charging outfit, consisting of a motor-generator set rated at 45 kw, is being installed. For caring for electric vehicles of the commercial type the charges range from $45 a month for a 750-lb. truck to $70 for a 5-ton truck. These charges cover the supply of energy, charging of the batteries, storage of the vehicle, daily washing and oiling and the making of minor adjustments. It is not the intention of the company to care for pleasure vehicles in the garage, since this work is receiving the attention of the regular garages, where a monthly charge of $30 is made for general garage services, covering charging of batteries, washing, oiling, etc. Since entering the field the author said he noticed that the vehicle manufacturers look for the assistance and co-operation of the central station and that every central-station manager along the Pacific Coast is fully alive to the possibilities of the electric vehicle as an energy-using device. If the manufacturers will for their part bring the cost of the truck within reach of the average merchant, the co-operation attained will be most effective and complete.

Discussion

The two papers devoted to the electric vehicle were discussed in common, Messrs. W. L. Bird of the Kaministiquia Power Company, Fort William; B. C. McBurney, of the Canadian General Electric Company; W. H. Munro, of the Peterborough Light & Power Company; A. A. Dion, of the Ottawa Electric Company; R. A. Merritt, of the Toronto Electric Light Company, Ltd.; G. W. Magalhaes, of the Toronto Electric Light Company, Ltd.; H. W. Hillman, of the General Vehicle Company; Wills Maclachlan, of the Trenton Electric & Water Company, Belleville; C. G. Keyes, of the Ottawa Electric Company; A. B. Lambe, of the Department of Inland Revenue, Ottawa, and J. D. Lachapelle, of Montreal, joining in the discussion.

Mr. McBurney stated that it was the intention of the Canadian General Electric Company to manufacture and assemble electric trucks at Peterborough. He also suggested that central-station companies act as agents for electric trucks, for by so doing they could standardize the trucks in a city and carry spare parts. Mr. Dion said that if the first cost could be spread over a number of years the price of the vehicle would not be so high. That gasoline cars are so much cheaper he attributed to large output, and he said if by means of co-operation more electric cars could be built the price of these would also be lower. He could not convince himself, however, that a central station should handle cars, since competition would bring best results. Manufacturers of vehicles, he contended, do not push the sale of their vehicles. His company was induced to buy a truck on the plea that the manufacturer could then sell others, but thus far the manufacturer has not made a sale. Mr. Merritt told of the status of the electric vehicle in Toronto, where the company is making no effort to push any particular vehicle. The rates for charging are 5 cents for the first 50 kw-hr., 1 cent for the next 50 kw-hr. and 0.5 cent for all in excess on one month's bill. The average return ranges from $10 to $12 per month per vehicle. There are at present eighteen electric trucks in use in Toronto and about 125 pleasure cars. The Toronto company also does not believe in acting as agent for any particular make of truck, because customers come to the lighting company for advice. By using tact with agents, he said, competition can be relied on to effect sales. The income per kilowatt demand from electric trucks, he claims, is five times what it is from other classes of service such as flatirons, heating devices, etc. The two charging stations in Toronto are equipped with motor-generator sets, payment for which the company accepts in instalments extending over five years. Rectifiers do not give good results in Toronto, owing to the fact that there are intermittent interruptions in the service and the regulation is not good. Mr. Hillman told of the sales made by the central stations in Hartford, Conn., and Baltimore, Md., the former selling 50 trucks and the latter 100. The Hartford company also sold during the month of May eight trucks to six new customers. He enunciated the principle that central stations should guide and lead the merchants in the vehicle business, as they do in the lighting and motor business.

Mr. Maclachlan questioned the feasibility of using electric vehicles in small towns where the roads are very bad and where paved streets do not obtain, and Mr. Lachapelle told of experiences in Montreal on bad streets where the chief item of expense was repairs to jars. Mr. Bird told of the excellent results obtained with electric vehicles in Denver and Kansas City.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Illuminated Billboard Advertising

Like electric-service companies in a number of other cities, the Commonwealth Edison Company of Chicago does a good deal of illuminated billboard advertising. The accompanying illustration represents one of the many bill-

ILLUMINATED BILLBOARD IN CHICAGO

boards used for this purpose. In this case the announcement relates to the domestic appliances sold in the Electric Shop. The illuminated display is painted in colors and is effective either by day or night. Five tungsten lamps in conical reflectors are used to illuminate the board. Similar signs are in use in various parts of the city to exploit the use of electrical energy and electrical appliances.

Boston Electrical Development Increasing

The report of the Wire Commissioner of Boston, Mr. James E. Cole, which has been made public for the year ending Feb. 1, 1913, shows a striking increase in electrical development during the period covered. The total generating equipment of the electric plants of the city expressed in engine and turbine rating, is 336,659 hp, compared with 294,128 hp a year ago, and there are now in service 26,129 motors aggregating 453,953 hp, compared with 22,858 motors of 365,217 hp combined rating early in 1912. The average size of motor is now 17.3 hp, or a gain of about 1.3 hp in the year. The largest system supplying motors with energy is that of the Boston Elevated Railway Company, which owned 8317 motors of 362,340 hp total rating at the end of the fiscal year as against 6911 motors of 285,640 hp rating twelve months previously. The Edison Electric Illuminating Company of Boston reported 15,250 motors of 70,541 hp on its system for 1913, a gain of 1709 motors and of 11,082 hp in the year, or about 18.5 per cent in its connected motor load.

At the date of the report there were 363 generating plants in service in Boston, there being no net gains or losses in the number of isolated plants in the city. Within the last five years the rating of the generating stations in Boston has increased by over 100,000 hp, or nearly 50 per cent. The underground electric service now installed comprises 2,123,687 ft. of conduit, 13,293,693 ft. of single duct and 16,959,649 ft. of cable, there being 9405 manholes. In the past year there were installed 180,688 ft. of conduit, 930,341 ft. of duct, 1,631,345 ft. of cable, 730 manholes, 1542 services and 9150 ft. Edison three-wire tube. Of this material the Edison company installed 1,211,134 ft. of underground cable, 369,695 ft. of duct and 98,754 ft. of conduit, exceeding the installation of all other concerns with the exception of the New England Telephone & Telegraph Company, which installed 393,358 ft. of duct. The wire used in Boston cable service varies in size from two-conductor telephone and messenger leads to 2,000,000-circ. mil feeders, the largest telephone cable having 600 pairs. During the year the department removed 191,800 ft. of overhead wire and owners removed 2,104,559 ft.

During the year the Edison company installed an additional 15,000-kw turbine at the South Boston station, with eight 508-hp water-tube boilers equipped with Murphy stokers in compliance with the smoke law. Additions have been made to various substations, and new substations are shortly to be completed for service in West Roxbury and in the rapidly developing Park Square section of Boston. During the year the Boston Elevated Railway Company installed a third 15,000-kw unit at its South Boston station.

Regarding fires, in the report it is pointed out that during the year none was due to wiring or apparatus approved by the department, and those due to electrical causes were with a few exceptions insignificant in character, the total insurance loss as a result of so-called electrical fires being only $13,917 for the entire city.

The Electric Vehicle in Department-Store Service

Investigation of electric delivery service for department stores frequently confronts central stations advocating motor-vehicle transportation, and data bearing upon this branch of the industry are often helpful in indicating the economy of electrical operation in comparison with horse traction. In the following tables are given the results of a recent study by a central station of the estimated cost of electrifying the service of a New England department store, comparing the expenses on a mileage basis and taking account of both fixed and operating charges:

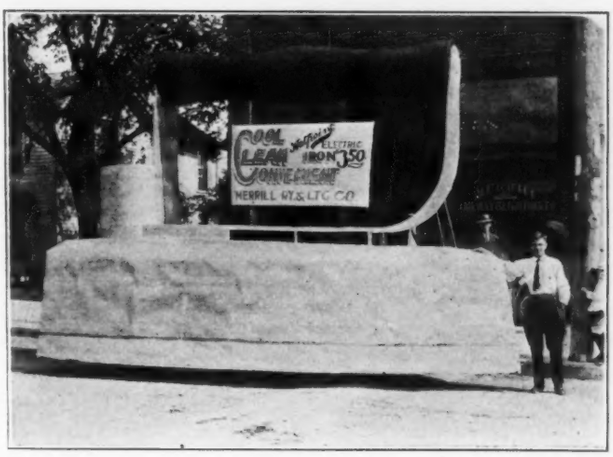
ELECTRIC DELIVERY SERVICE FOR NEW ENGLAND DEPARTMENT STORE

Cost of one delivery wagon less horses, tires and batteries, but including plain, open express type body with four-post top and side entrance....	$300.00	$1,650.00
Cost complete with body, Edison A-4 battery and tires, or two horses and necessary harness....	900.00	2,600.00
Depreciation on complete wagon, less tires and batteries or harness and horses.....	30.00	165.00
Interest at 5 per cent on complete investment..	37.50	88.75
Fixed yearly cost.....	67.50	253.75
Fixed daily cost.....	0.23	0.85
Operating Cost per Mile:		
Electricity, at 0.8 cent per kw-hr., off-peak rate..	...	0.45

Horse feed: Oats, $0.60; hay, $26; 15 qt. oats per day, 10 qt. Sunday; 12 lb. hay daily, 8 lb. Sunday; cost per week, two horses, $5.83; cost per mile for 200 miles per week	0.029	...
Depreciation on batteries, $1,200 for eight years, 15,000 miles per year	....	0.01
Depreciation on horses, $550 for four years, 10,000 miles per year	0.014	...
Depreciation on tires, "Firestone," $140 set solid, 10,000 miles	....	0.014
Depreciation on harness, 14 per cent or $8 per year; shoeing, $1 per week for two horses; wagon repairs, $15 per year; veterinary service for two horses, $10; total cost per year, $85 per mile	0.07	.....
Mechanical upkeep	...	0.04
Wages for auto delivery service: Driver, $2.50; helper, $1; total, $3.50 for 50-mile day; per mile	...	0.07
Wages for horse delivery service: Driver, $2.25; helper, $1; total, $3.25 for 33-mile day; per mile	0.10	0.1025
Total operating cost per mile	0.15	.....
Operating Cost per Day:		
Operating cost, 33 miles per day	4.95	3.38
Daily fixed charges	0.23	0.85
Stable and garage service, washing, polishing, etc.	1.00	0.50
Total operating cost per day	6.18	4.73
Saving per day by electric service, 23 per cent, or	...	1.45

A Winning Flat-Iron Float

The winning float exhibited in the industrial parade held at Merrill, Wis., July 4, was the mammoth electric flat iron entered by the Merrill Railway & Lighting Company, and



FLAT-IRON FLOAT, MERRILL, WIS.

illustrated herewith. This monster iron was constructed of light wood ribs covered with paper and cloth, the whole form being built over the body of a Detroit Electric underslung roadster. The "iron" measured 18 ft. long, 10 ft. wide, and 14 ft. high. Advancing down the street with no visible guidance or means of propulsion the display created lively interest among the by-standers. The illustration was furnished by Mr. F. W. King, and shows the unique display standing in front of the Merrill company's office.

St. Louis Board of Education Purchases Electric Trucks

To replace its horse-drawn vehicles the St. Louis Board of Education has recently purchased four Baker electric trucks which will be used in distributing supplies and in transferring furniture. Permanent garages will eventually be built but at present the warehouses used by the board are being utilized as temporary garages. Electricity for charging the batteries is furnished by the municipal generating station. Three of the trucks have two tons capacity, and the fourth is capable of hauling one ton. Each of the trucks is supplied with Exide Ironclad storage batteries. In choosing this type of vehicle it was found that the mileage required on one charge and the traffic speed desired was within the possibilities of the electric truck. In answer to bids for furnishing drayage facilities, the electric truck was quoted at a lower figure than horse vehicles.

Electric-Cooking Service in Two Idaho Cities

The valuable results to be accomplished by energetic electric-cooking campaigns have been fully demonstrated during the past few months by the commercial departments of the Great Shoshone & Twin Falls Water Power Company of Twin Falls, Idaho, and the Southern Idaho Water Power Company of Pocatello, Idaho. Early in the summer of 1912 there was begun a campaign of advertising, publicity and education of the public in the use of electricity for cooking purposes. This was not attempted, however, until many tests had been made to determine the most reliable electric-cooking devices available.

Newspaper advertising was followed by a rapid succession of circular letters, tending to interest the public further in the advantages of the electric range over fuel-burning stoves. Public demonstrations of electric cooking were held, and the people turned out by the hundreds. At one exhibition in Twin Falls more than 1000 visited the display rooms in one day, and each was served with a small portion of a daintily prepared, electrically cooked food. The demonstrations were followed up by well-planned solicitations for the sale of electric ranges among consumers.

During the fall of 1912 about sixty complete electric ranges of various sizes were sold. A carload of 125 Simplex ranges was ordered later during the winter, and practically all of this shipment has already been actually sold or spoken for. Five hotels and several restaurants and bakeries have during the past six months discarded all kitchen fuel and are using electricity exclusively for cooking and baking purposes.

The greatest difficulty experienced thus far in the sale of electrical ranges is the fact that the customers have no means for disposing of their fuel ranges. Were the people able to dispose of their fuel ranges at anything like a reasonable price, there would be little difficulty in selling a thousand electric ranges during the current year. The campaign of advertising and publicity has been very fruitful, and the public is not only interested but it is already thoroughly convinced that the electric way is really the best.

The two companies referred to have adopted a rate of 2.5 cents per kw-hr. for energy used for domestic cooking. For commercial cooking the guarantee-rate schedule is as follows:

COMMERCIAL COOKING RATES

Monthly Guarantee per Kw Connected	Rate per Kw-hr., Cents
$1.50	2.0
2.00	1.5
2.50	1.4
3.00	1.2
3.50	1.0

A marked diversity-factor is to be considered in determining the actual revenue obtained from electric-cooking installations. This is especially true in the case of domestic electric-range equipments. It is reasonable to consider three divisions: one due to the non-coincident use of all the ranges connected, one due to there being separate switches for each heating element, and one due to the three-heat arrangement on each individual element. The maxi-

mum demand of the Simplex ranges used in Idaho is cut down by the use of a switch so arranged that the oven and broiler cannot both be connected at the same time. By this arrangement the maximum demand of the No. 6 range is reduced to 3215 watts and that of the No. 7 range to 3510 watts. This has been found to work little or no hardship on the one using the range and is an advantage to the electric-service company. From the company's records of its consumers the average revenue from the domestic cooking ranges installed prior to April 1, 1913, was $3.89 per range.

Electrical Propaganda on Wheels

Leaving Chicago on Independence Day for Marshall, Mo., the new electrical exhibition car *Electra* of the Middle West Utilities Company began a career that is hoped to have a sensible influence in extending the demand for electricity in smaller cities and towns of the country. Reference was made to this car on page 1154 of the *Electrical World* of May 31 last in the article entitled "Unified Public Utilities in Central Illinois." The car is sent out under the direction of Mr. Mike S. Hart, general manager of the commercial department of the Middle West Utilities Company, and is in immediate charge of Mr. F. H. Soden, an electrical man of wide experience, who travels with the display.

The car, illustrated herewith by exterior and interior views, is 60 ft. long and 10 ft. wide over all. It is a standard-gage double-truck car built by the McGuire-Cummings Manufacturing Company of Chicago, especially for the purpose of giving electrical exhibitions, demonstrations and entertainments in various cities, and is designed to operate over steam and electric railways as a trailer.

It is planned to spend a day or two in each town visited. Several hundred feet of insulated wire is carried by which the car may be connected to a local pole line wherever it is stopped. In the car there is a regular distributing board controlling the various circuits, including the outside signs and the outlets to which apparatus is attached for demonstration. A Thomson watt-hour meter measures the consumption of energy.

Arrived in a town, the car is connected to the local source of electrical energy. After dark a screen which is carried is set up about 100 ft. from the car and by means of an Edison machine, also forming a part of the car's equipment, a moving-picture show is given. This and the previous announcements serve to attract an audience. A phonograph is part of the equipment and this gives selections during the intervals between moving-picture displays. After the show the audience is invited to inspect the exhibition in the car. Mr. Soden travels with the car from point to point and is aided in each town by local salesmen. The car runs on a two-week schedule.

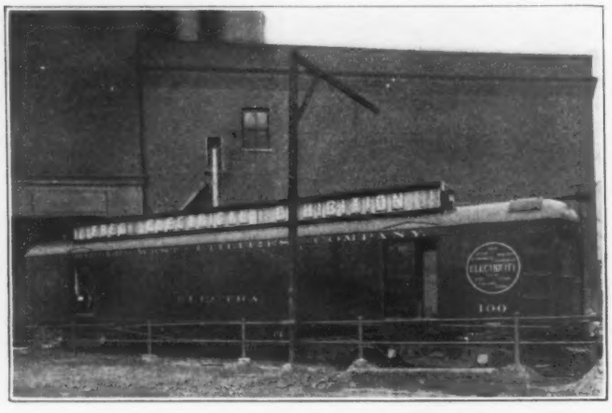


FIG. 1—EXTERIOR OF EXHIBITION CAR

Electric signs form a conspicuous feature of the exterior. The words "Free Electrical Exhibition" are outlined in electric lamps when the car is stationary at night, two signs extending longitudinally on the roof of the car one on each side. When the car is traveling these electric signs are covered by outside painted signs lettered with the words "Do it Electrically." The large electric signs are operated by a flasher installed inside the car. Ten-watt tungsten lamps are used. In addition there are miniature signs displaying the words "Entrance" and "Exit" above the four main doors leading into the car. Folding steps with railings are provided to give access to these doors from the ground. During cold weather the car will be heated by a hot-water system.

FIG. 2—INTERIOR OF EXHIBITION CAR

The interior of the car contains a large exhibit space surrounded by a substantial railing and with a passageway running alongside. At one end is the office and stateroom, with sleeping accommodations, for Mr. Soden, and at the other end of the car a complete electric water-pumping outfit as a demonstration, and the heating plant. Every inch of space in the car is utilized to some purpose. Printed matter is laid out for distribution on the railing and signs of various kinds are displayed. Three windows are provided on the passageway side of the car.

A great variety of electrical appliances is exhibited, including flatirons, lamps and fixtures, desk lamps, cooking stoves, washing machines, cooking utensils, percolators, toasters, signs, meat choppers, desk fans, luminous heaters, miscellaneous motors, coffee grinders, vacuum cleaners, electric drills, bell transformers, electric incubator, feed grinder, glue pot, sewing-machine drive, horse clippers, soldering irons, dentists' equipment, vulcanizers, pumping machine, electric traveling sets for women, massage apparatus and other electrical necessities and conveniences.

The apparatus exhibited was purchased outright by the Middle West Utilities Company from a number of manufacturers, including the General Electric Company, Westinghouse Electric & Manufacturing Company, Simplex Electric Heating Company, Federal Sign System (Electric), Hotpoint Electric Heating Company, A. J. Deer Company of Hornell, N. Y.; Chicago Pneumatic Tool Company, Electric Manufacturing Company of New Orleans, Reliable Electric Company, Dayton Pump & Manufacturing Company, Chicago Miniature Lamp Company, Pelouze Manufacturing Company, Hylo Lamp Company and Mid-West Sales Company.

In addition to the electric signs the exterior of the car is tastefully lettered with painted signs. One inscription arranged in a circle reads "Safe, Clean, Modern, Economical, Convenient Electricity for the Home, Store, Factory, Farm." A special effort will be made by means of this car to bring about a greater use of electricity.

Illumination and Wiring

Electric Wiring and Illumination of the Continental and Commercial Bank Building, Chicago

Modern practice in the electrical equipment of a large banking and office building is well displayed in the construction of the Continental and Commercial National Bank

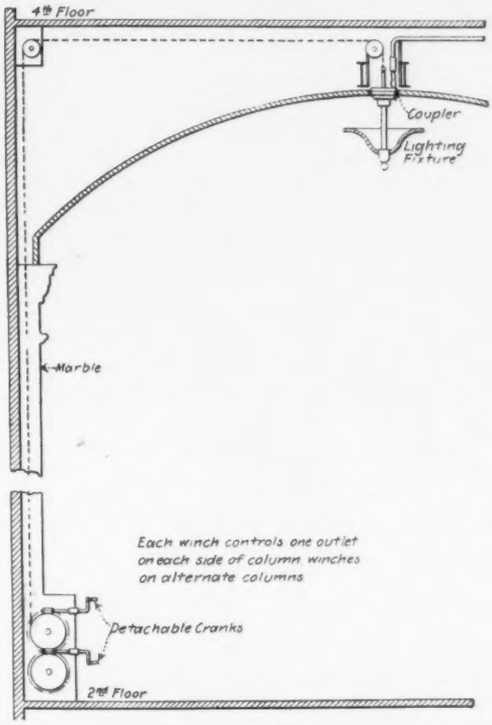


FIG. 1—SCHEME FOR LOWERING LIGHTING FIXTURE

Building in Chicago, now nearing completion. The edifice is one of the largest office buildings in the city, occupying an entire block. It is a twenty-story structure, 260 ft. high, having a frontage of 323 ft. on West Adams and Quincy Streets and 166 ft. on South LaSalle Street and South Fifth Avenue. The framework of the building consists of steel; the exterior walls on the lower floors are built of granite blocks, and the remainder of the exterior is of dull-finished terra cotta, matching the granite.

The greater portion of the first floor will be occupied by the Hibernian Banking Association and the Continental & Commercial Trust & Savings Bank. The second floor, which is really the main floor, will be used by the Continental & Commercial National Bank. Here the entire space, with the exception of the four corners of the building, which are devoted to elevator shafts, is taken up by banking quarters. No pains have been spared by the architects, D. H. Burnham & Company, in making every detail on this floor elaborate. Running the whole length of the central portion of the building is a large semi-cylindrical arch having a radius of 32 ft. with crest about 65 ft. above the level of the banking floor. A portion of this arch is covered with a clear-glass skylight which opens into a court which extends up through the building. It is asserted that this is the largest clear-glass skylight which has ever been installed.

On each side of the main arch are two smaller arches running parallel to it, with crests about 38 ft. above the level of the floor. The drop beams between these arches are supported on tan-colored marble columns arranged in four sets of ten columns each. Two spacious stairways open into the central portion of the banking space opposite the LaSalle Street and Fifth Avenue entrances.

In addition to occupying the second floor the bank will use the third and third mezzanine floors as well as about one-third of the fourth, fifth, sixth and seventh floors. The remaining portion of the upper floors will be leased to tenants, most conspicuous among whom, perhaps, will be the United States Steel Corporation and its subsidiaries, which will take about six floors.

Electric Crane for Skylight Cleaning

The electrical equipment of this building is no less interesting than the architectural construction. One of the novelties is an electrically operated traveling crane, by means of which the under side of the skylight will be cleaned and washed. This crane consists of a steel arch supported on wheels which run on tracks on each side of the main arch. As the wheels on both tracks are designed to exert a tractive effort, and as only one motor is used to drive them, a series of shafts and bevel gears is used to connect them. The motor which is of 2 hp, is supported on the south leg of the traveling crane, and is operated by a 110-volt storage battery, also supported on the crane. On the top of the crane are steps on which the men who clean the skylight may stand. Tanks containing the water used in cleaning the skylight are also supported on the crane.

To conceal the crane when it is not in use, a receptacle was built in the wall at the west end of the main arch. In this recess is a 110-volt terminal and a battery-charging rheostat. When the crane is run into the recess it is concealed, as one side of the crane is designed to match the rest of the building, and is plastered and decorated to correspond to the opposite end of the main arch. The storage battery was used instead of a third rail so as to avoid any additional conspicuous rails and also to prevent accidents. It is designed to furnish enough energy to operate the crane through eight round trips on one charge.

Illumination in the Banking Space

Perhaps the most interesting feature of the illumination of the building consits of the lighting in the banking space on the second floor. Supported from the crests of all of the arches in each bay are semi-indirect lighting fixtures, containing eleven 60-watt tungsten lamps, arranged so that they can be lowered for cleaning and relamping. Each of these fixtures is supported by two bronze cables which run

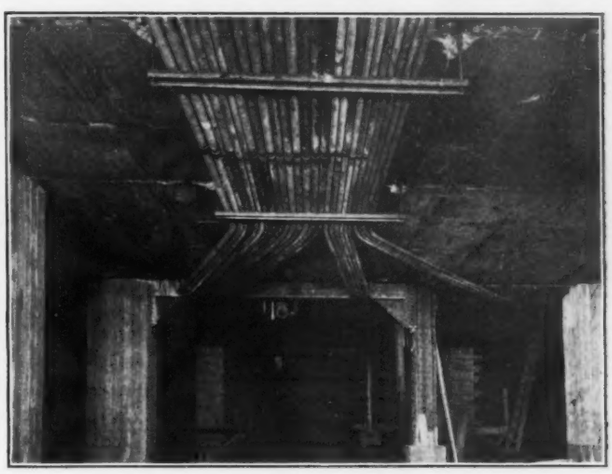


FIG. 2—CONDUIT HUNG FROM CEILING

over pulleys concealed in the ceiling and terminate in a hand-operated winch. When the fixtures are lowered the electrical connection is automatically broken at the ceiling so that the lamp sockets can never be energized when the fixture is being cleaned or relamped.

The disconnect device consists of two plungers which form the terminals of the lamp fixture. When the fixture

is in position to be lighted the plungers are pressed by helical springs against segments which connect with the terminals of the service lines. An interlocking device is installed which prevents arcing at the disconnecting point by opening a service switch when the fixture is lowered.

It may be interesting to note that these lamps are all fed from the fourth-floor cut-out cabinets, on account of the height of the ceiling, and are controlled by momentary-contact pilot switches which operate remote-control switches located in the cut-out cabinets on the fourth floor. The pilot switches are installed in gangs on columns at four corners of the banking space, so that all of the bank ceiling lamps can be controlled from any one of these positions.

In addition to the arch-ceiling fixtures which can be lowered for cleaning there are, in the banking space, some other illuminating features of interest. At each end of the skylight on a level with the fourth floor and beneath the main vaulted ceiling, are beams having channel sections, the recess in which opens upward. The recess in the beams is utilized as an indirect fixture, and each beam contains about sixty-six National X-Ray cone and scoop reflectors set in two rows and connected by conduit. The scoop reflectors are used on the row nearest the central banking space; cone and scoop reflectors placed alternately are used in the row farther from the banking space. All of the scoops are set so that the center line of the sockets is vertical. From the ends of the beams in toward the centers the angle which the axis of the cone reflectors makes with the vertical is varied so that the light is well distributed over the ceiling. These lamps are also fed from the fourth-floor cabinets and are controlled by pilot switches located at four positions on the second floor.

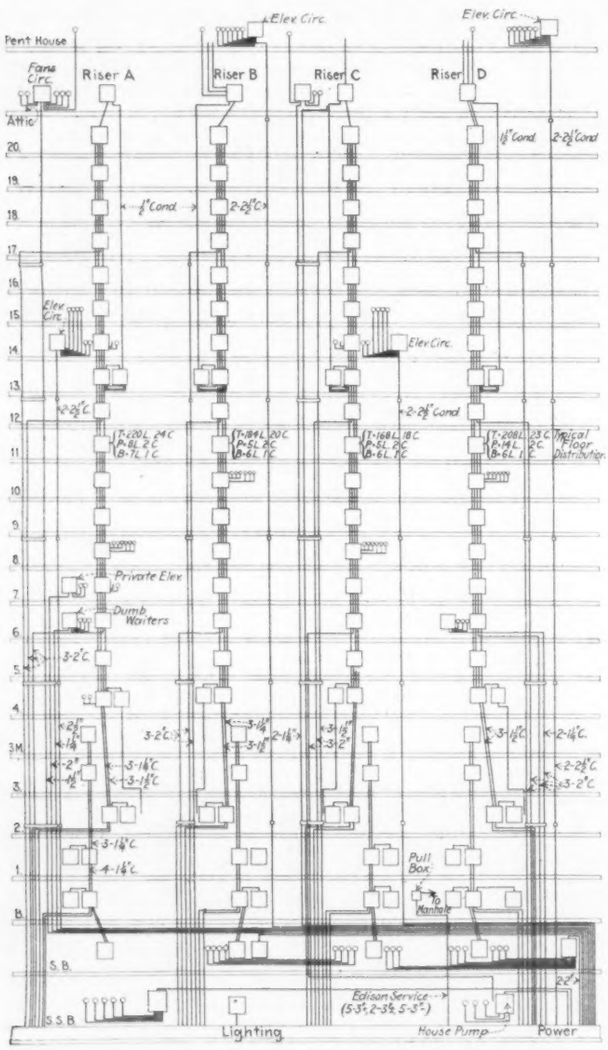


FIG. 3—RISER DIAGRAM

Indirect Lighting in the Offices

A large number of the office tenants in the building will use indirect-lighting fixtures. After the first feeder system was laid out a general desire for indirect lighting was manifested, and the cross-section of the feeders was increased so that the entire building could be lighted by that method. All of the fixtures were furnished by the Acme Chandelier Company.

Window-Washing Device

To facilitate washing the large number of windows which light the banking space on the second floor, a unique device is installed on each side of the room. The apparatus, which is about 30 ft. high, looks like the transverse traveling ladders seen in shoe stores and storerooms. It is electrically operated. A 2-hp, 220-volt motor, supplied with energy through a trailing cable plugged into receptacles on alternate columns, operates the ladder in a transverse direction and also operates a small hoist in which the person cleaning the windows sits when he is working.

Vault Space and Coupon-Booth Lighting

There are three vaults located in the basement of the building. As it was undesirable to pierce the armor-plate walls of these vaults in order to run electrical conduit in for lighting, another scheme was employed. For each vault a 110-volt sub-feeder cable is run from one of the auxiliary risers, located in the basement, to a sheet-steel cabinet located on the same floor, in which a circuit-breaker is installed. From the circuit-breaker service wires are run to a receptacle on the exterior of the vault walls near the vault door. Lamps are installed inside of the vault and are connected by steel conduits to a receptacle on the inner vault wall. When it is desired to have a light in the vault the steel door is opened and a flexible cord is used to connect the receptacles mentioned. The circuit-breaker which is installed in the cut-out cabinet is employed to open the circuit in case the vault door closes and short-circuits the flexible cord connecting the receptacles. As one of the vaults has two doors, one main and one auxiliary door, an alarm system is installed to notify the bank clerk in case he fails to close and lock both doors.

Coupon booths are located on the basement floor for the use of patrons of the vaults. Each booth is about the size of a public telephone booth, and is lighted by two lamps. One lamp is supported on a bracket above the desk provided in the booth; the other lamp is held in a screw-clamp socket beneath the desk to illuminate the space below it and eliminate any shadow which might conceal valuable papers dropped on the floor. The circuit supplying both lamps is closed by a door switch when the occupant closes the door.

Service Inlet

At the time this was written it was still undecided whether central-station electrical energy would be purchased. In any case, however, a connection will no doubt be made with the outside service mains in Adams Street through the curb wall to a sheet-steel pull box located on the north curb wall of the building. As planned, twelve 1,500,000-circ. mil cables will enter the pull box from the back near the top and make a right-angle bend and emerge from the bottom of the box. The cables will be carried down behind a curtain wall to the basement floor and run through the floor structure, which is of concrete, to outlets located above and back of the switchboard. Because of this construction it will not be necessary to install service switches previous to the cables' entrance above the switchboard. Five of the cables are of positive polarity, five are negative, and two are neutral. Two empty conduits are in place as reserve for future equipment.

SWITCHBOARD

The switchboard, which is located on a gallery in the sub-basement, consists of polished blue Vermont marble panels and stands 90 in. high. The panels extend down to the floor line and rest on channel irons securely grouted to the floor. Over the top of the board inclosure is a 0.125-in. sheet-steel plate to which the down-coming cables are fastened with locknuts and bushings.

There are three service panels in the center of the switchboard, on which are mounted single-pole service switches, each capable of carrying 1500 amp. On the left of these panels are the energy-distributing panels for the motors installed in the building, and on the opposite end of the switchboard are the lighting-distribution panels. The distribution panels are equipped with feeder switches supplying the circuits.

On the main service panels are the integrating watt-hour meters for recording the amount of energy supplied for public lighting, elevator service and miscellaneous motors. All of the energy supplied to the bank and tenants is measured by meters installed in the cabinets on the floors from which they receive their energy. Separate buses are provided for light and motor loads, and are supported on insulated brackets secured to the angle-iron frame of the switchboard, so that no portion of their weight comes on the switch or fuse studs.

WIRE SHAFTS AND CUT-OUT CABINETS

From the switchboard to the fourth floor there are no regular wire shafts and the cables are carried through auxiliary shafts which are connected on the various levels by offset conduits. From the fourth floor up there are four wire shafts located on each floor at the corners of the building near the elevator shafts. The feeder cables are brought out above the switchboard and are carried along the ceiling of the sub-basement on horizontal supports hung from the I-beams overhead. The cables are run parallel to the walls of the building to the auxiliary shafts, of which there are four. These shafts connect with the main shafts which were previously mentioned.

In every shaft on each floor are cut-out cabinets containing fused main-line switches, each capable of carrying

FIG. 4—CONDUIT ENTERING RISER SHAFT

the total amount of energy supplied from its respective cabinet. In addition each cabinet contains a metering panel which measures the amount of energy supplied to the tenants. Plug-type fuses are installed in each office circuit on a standard type fuse-terminal board.

The construction of the cabinets is interesting. Each cabinet is made of No. 10 sheet steel and contains two compartments: one in the rear about 10 in. deep to contain the necessary connections between the cables and the panels, and a somewhat shallower compartment in the front for the fuse, meter and switch panels. A large door opens into the front compartment, and two side doors open into the rear wiring compartment. These are fitted with piston bolts and locks. All of the panels in the building are of the same

FIG. 5—SERVICE FEEDERS RUNNING TO SWITCHBOARD

type. The feeder cables enter from the bottom and pass through the rear compartment only. The cabinets are placed in the shaft opening so as to be directly over the cables which are to supply them with energy, thus avoiding any bends in conduits through which it would be difficult to thread the feeders. Each branch circuit is numbered and a typewritten directory explaining the circuits is placed under a heavy plate of glass which is inclosed in a frame on the front door of the cabinet. A wall receptacle is secured on the face of each panel in the cabinet to facilitate the inspection of the board. Entrance to the shaft space where the cabinets are located is obtained through wooden doors hinged from either side and parted in the middle. The wiring shaft is lined with fire tile.

All of the cut-out panel boards, with the exception of those used for public lighting, are constructed so that the energy passing through any circuit or combinations of circuits may be measured without rearrangement of external wiring.

Main feeders which supply the cut-out cabinets are securely anchored at their upper terminals, and are supported by cable racks inclosed in sheet-steel pull boxes at intervals of three or four floors. These cable racks are built of heavy strap iron hung from the I-beams at the back of the slot in the floor. At no point do the cables come in contact with metal; each support is made of porcelain. In addition to the supports mentioned the cables are supported at each cabinet by porcelain insulators. The feeders inside the conduit are gripped at intervals by split-knob strain insulators.

FEEDERS FOR LAMPS AND MOTORS

Intsead of dividing the building into sections by floors and feeding each section from a midpoint, as is usually done to improve regulation, the various sections of tenant lighting are fed from the lowest point of each section, and the cross-section of the feeders is designed so as to keep the voltage drop at a minimum.

Lighting feeders are proportioned so that with all of the lamps in the building burning, there will be only a drop of three volts between the main switchboard bus and each of the cut-out cabinets, measured across the outside legs of the three-wire system. The loss of potential across any one

of the two-wire 110-volt circuits from the cabinet to the farthest lamp will not exceed 1.5 volts.

Public or corridor lighting is supplied over a separate set of feeders which are also carried up through the auxiliary and main shafts the same as the tenant lighting feeders. One public lighting feeder capable of feeding all of the public lamps on the second, fourth, and upper floors is carried up each of the main shafts. From this feeder several sub-feeders are run to the distributing centers. Practically all of the public lighting, with the exception of the lighting on the first floor and that in the banking space on the second floor, is controlled from a cut-out cabinet located on the thirteenth floor.

On account of the time required to turn on public lamps from their respective floors, it was decided to control all

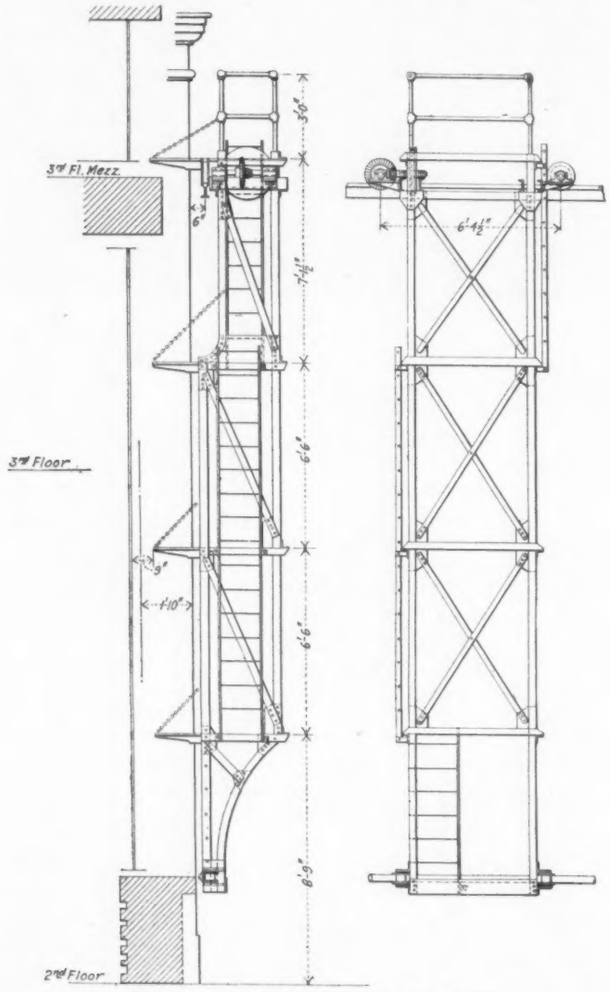


FIG. 6—WINDOW-WASHING APPARATUS

of the public lamps, with the exceptions mentioned, from the thirteenth floor. This floor was also selected because it is halfway between the upper and lower floors thus controlled.

On each floor there are twelve corridor emergency lamps, one of which is placed at each corner of the building; the remainder are spaced at equal intervals down the corridor. Stairway lamps are also used as emergency lamps. These lamps are fed from the cut-out cabinets which are nearest them on their respective floors, and are controlled from the thirteenth floor. Two switches are installed in each of the cabinets on that floor, one of each set controlling all of the lamps below the thirteenth floor, and the other switch controlling the lamps on the thirteenth floor and above.

Practically all of the motors installed in the building will be operated at 220 volts, and are supplied at the place of installation with individual circuit-breakers and fuse panels enclosed in cabinets similar to the main shaft cut-out cabinets. The distributing cabinets which supply these motors are equipped with sub-feeder switches and fuses except in the case of elevator cabinets, which are equipped with circuit-breakers. Two sets of motor feeders are carried up each shaft and connect with sub-feeders at different points which feed the distributing centers.

In the sub-basement there will be eight motors installed with an aggregate rating of 155 hp; in the sub-basement there will be sixteen motors having a total rating of 233 hp. On the upper floors there will be motor units as follows: Sixth floor, six with total rating of 5 hp; seventh floor two with total rating of 25 hp; fourteenth floor, twelve with total rating of 35 hp; attic, seven units with a total rating of 145 hp; pent house, fourteen units with a total rating of 465 hp.

Distribution of Circuits for Office Lighting

From the cut-out cabinets on the various floors two-wire 110-volt lighting circuits are carried to the different offices and corridors in conduits, none of which is less than 0.75-in. in diameter. In laying out the circuits 660 watts was the maximum load which was allowed to be supplied by any of the branch circuits.

At each outlet is a pressed-steel outlet box of the knock-out type, which is secured to the conduit feeding it with a lock nut and bushing. The ceiling outlet boxes have an independent support aside from that given by the conduit. This support consists of a pipe nipple fastened to the box with a lock nut and bushing which extends through the floor and terminates in a tee which rests on a cross-bar that transmits the weight to the floor arching.

Where direct lighting has been employed instead of indirect, the fixtures are designed for 40, 60, 100 or 150-watt lamps as desired, supported in sockets adapted to the fixtures and designed by the Benjamin Electric Manufacturing Company of Chicago. White-glass shades are used in most cases.

In the public corridors from the fourth to the twentieth floors, 20-amp flush receptacles are installed every 50 ft. on one side of the hall to supply energy for portable electrical apparatus, such as rotary scrubbing brushes.

Telephone and Telegraph Connections

Telephone and telegraph connections in a building of the magnitude of this one are of interest. The service mains of the Chicago Telephone Company will enter the building on the west and are run along the ceiling of the basement, exposed, to the telephone service room, which is located in the basement. A sheet-steel thimble is set in the floor of the service room, so that it is flush with the sub-basement ceiling, and the distributing cables are run through this thimble into the sub-basement, where they are carried along the ceiling to the wire shafts. Similar thimbles are installed in each wire shaft on every floor except where there are offsets in the shafts.

At each offset there are three 3-in. conduits and two 2-in. conduits connecting the shafts; two of the 3-in. conduits contain the Chicago Telephone Company's cables; one 3-in. conduit is used by the Chicago Tunnel Company (operating the automatic telephone system), and the 2-in. conduits are used for telegraph and low-tension cables. The telephone service of the Chicago Tunnel Company enters the building through a tunnel connection. The cables run exposed along the sub-basement ceiling to the four wire shafts mentioned previously.

Exterior Lighting

Exterior lighting will be employed on the parapet and pent-house walls as well as at the La Salle Street main entrance. Along the parapet walls, spaced at intervals of about 17 ft., are ornamental urns supporting frosted glass

globes which contain tungsten lamps. Each of the globes located at the corners of the building contains four 150-watt tungsten lamps, and each of the globes along the side walls contain one 150-watt lamp. On the La Salle Street side of the building along the pent-house walls, are hemispherical "bull's-eye" lenses spaced 6 ft. center to center. Behind these lenses are 250-watt tungsten lamps, the light from which is reflected toward the street by parabolic reflectors. All of these lamps are controlled by remote-control switches which are operated by pilot switches located on the thirteenth floor. Over the piers in the La Salle Street entrance are eight ornamental brackets. All of these fixtures were designed by the Acme Chandelier Company.

VACUUM CLEANER SYSTEM

For the purpose of cleaning the corridors, office suites and banking spaces a vacuum-cleaner system will be installed throughout the building. Two electrically driven vacuum-cleaner pumps are located in the sub-basement. Each of the driving motors has a rating of 25 hp and will be connected by a silent chain drive to the vacuum pump. One set is sufficient for ordinary use and the other is held in reserve.

Discharge pipes from the vacuum pumps are run to the

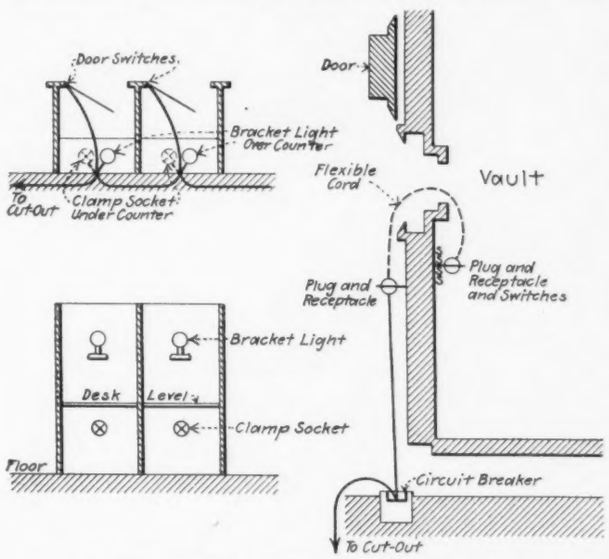


FIG. 7—ILLUMINATION OF COUPON BOOTH AND VAULT

smoke breeching. Suction pipes connect the pumps with a riveted steel tank from which feeder pipes are run to the various distributing centers on the different floors of the building. Each riser is clamped to the beams or walls at every floor. A sufficient number of outlets is provided on every floor so that the entire floor may be cleaned without using more than 100 ft. of hose from each outlet.

HEATING PLANT

Four Babcock & Wilcox boilers, each having about 5000 sq. ft. of heating surface, are installed in the sub-basement to generate steam for heating purposes. Coal for firing the boilers may be obtained from two sources—from coal cars brought to the building through the tunnel of the Chicago Tunnel Company, or from wagons on the street above. The tunnel will be utilized for bringing in the coal supply ordinarily used, in which case the cars will be run into the building through the tunnel entrance and will be raised on a tunnel lift to the proper level from which to unload into the main receiving hoppers. When the supply of coal is brought to the building in wagons it is unloaded through manholes in the sidewalk into four coal storage bunkers below.

The handling of the coal after delivery presents some interesting features. Running parallel to the firing aisle is an endless belt conveyor, which takes coal on its upper travel from the main receiving hoppers near the tunnel entrance and conveys it to coal hoppers which feed the stokers, and to the auxiliary receiving bin. Only part of the coal carried on the belt will be delivered to the stoker hoppers on its first trip, as the supply brought in will be generally much in excess of the amount required for normal firing. An auxiliary conveyor running parallel to the first one but along the center line of the coal bunkers, receives coal from the auxiliary receiving hopper on its lower travel, and conveys it to the adjacent coal storage bunkers which communicate with the street manholes.

From the coal storage bunkers to the stoker hoppers the coal brought in through the tunnel and the coal brought by wagons, is conveyed along the same route. The construction of the bunkers is such that the coal is discharged onto the lower travel of the main conveyor and is carried up to the hoppers which feed the stokers.

Ashes may be disposed of by means of the main conveyor. They are raked from the ash pits under the grates onto the lower travel of the main conveyor and are delivered either to ash hoppers located above the main coal receiving hoppers near the tunnel entrance, or to auxiliary ash hoppers located above the main coal receiving hoppers near the tunnel entrance, or to auxiliary ash hoppers near a sidewalk lift. From the main ash hopper the ashes can be delivered by gravity into tunnel cars, and from the auxiliary ash hopper the ashes can be delivered to a telescoping ash elevator arranged to lift the ashes and discharge them into a wagon in the street. By the arrangement mentioned two methods of coal supply and ash disposal are obtained, each entirely independent of the other.

The main conveyor is of the pivoted, overlapping-bucket type and the auxiliary conveyor is of the gravity-discharge type. On vertical runs the conveyors are encased in sheet-steel casings to prevent any person being caught in them, and also to avoid spilling the contents of the conveyors on the floors. Each conveyor is capable of delivering 40 tons of coal an hour at a maximum speed of 40 ft. per minute. Each of the conveyors is operated by a 25-hp motor, and the ash lift is operated by a 5-hp motor. Each motor is furnished with a starting rheostat, speed controller and circuit-breaker.

ELEVATORS

There will be twenty-four electric passenger elevators in the building, twelve of which are high-rise elevators, the remainder being low-rise elevators which run only to the fourteenth floor. The building has been constructed, however, so that the low-rise shafts may be extended to the top of the building if traffic demands the change. These elevators are manufactured and installed by the Otis Elevator Company. The motors used for operating the elevators are of the one-to-one gearless traction type, each having a rating of 35 hp. Up-and-down signals are used on the elevators, both for informing the elevator operator and the passenger. The energy for operating the signals is supplied by small motor-generator sets located in the pent house and fed from the public lighting feeders.

In addition to the regular elevators mentioned for the use of all occupants there are two private elevators for the use of the bank employees only, which operate between the vaults in the basement and the sixth floor only.

There are three hydraulic sidewalk lifts, for which the water pressure is maintained by electrically driven pumps. One of these lifts has its plunger cylinder interchangeably connected with a high-pressure or a low-pressure pump so that an abnormally heavy load may be lifted when desired.

VENTILATION AND REFRIGERATION

Ventilation is maintained by electrically driven inductive and exhaust fans. The former are located in the sub-basement; there are eight in all having a total rating of 112 hp. Seven exhaust fans having a total rating of 145 hp are

located in the attic. Two other exhaust fans are located in the pent house and have a total rating of 55 hp.

Before the air is admitted to the ventilating shafts it passes through air-washing chambers in which there is a continual shower of water which removes the dust. The water is pumped by three electrically driven air-washing pumps having a total rating of 6 hp. The illumination in these rooms is somewhat different from that ordinarily used in such cases. Instead of placing the lamps on the outside of the room and arranging them so that their light is reflected through a glass inspection door into the air-washing chamber, the lamps are placed inside. They are supported from the ceiling in marine sockets.

Refrigeration for cooling the drinking water in the building is furnished by an absorption system.

The Thompson-Starrett Company is the main contractor for the building construction, L. K. Comstock & Company having the sub-contract for the electrical work.

Letter to the Editors

Furthering Electrical Invention

To the Editors of the Electrical World:

Sirs:—There is no more important subject before the electrical industry to-day than the solution of its inventive problems. At the present time these problems present themselves in a haphazard manner to a few individuals. These men may not themselves have the inventive faculty, and so years go by before a genuine inventor notices the difficulty and solves it.

But supposing on the other hand that engineers, electricians and others would give publicity through the columns of your paper to the difficulties encountered by them in their practice. Even if only one out of the thousands of your readers should create an improvement over existing methods, progress in the art would be that much furthered. No more important topic for discussion in your columns can be imagined than this, which would aid in an accelerated progress of the electrical industry. Compared with the present practice how much better would it be if the needs and problems now known to a few, could be spread before the hosts of your readers, thus letting all combine in hastening development.

To open the subject, here are a few inventive problems which have come to the writer's attention as apparently still awaiting solution.

1. While inspecting a house with regard to renting it, we found the laundry table on fire, and the maid fled. The incendiary (an electric flat-iron) stood in the midst of the conflagration. A word to the wise is sufficient.

2. Engineers complain of the undue jerking of rotors at starting, especially in hoisting machinery.

3. How much longer must we endure the test clicks heard by the calling subscriber while waiting for the called party?

4. People still steal electrical energy by by-passing the meter.

5. An electric motor starter seems to say, "I am doing the best I can," which isn't very much in the opinion of buyers and users.

6. Electric connectors are coming to be known as devices which will hold wires connected except when they inadvertently pull asunder.

7. I searched the shops for an electric massage vibrator, but refused to buy any as I suspected that the noise they made would be more injurious to my wife's nerves than the good they could ever do to her circulation by massage.

8. When I learned that people often broke their wrists by the kick of the starting crank on automobiles, I lost my desire to buy that kind, as a lost wrist means lost business. An electrical invention might assist in solving this problem.

9. No longer does the motorman on a trolley car have to leave his platform to actuate the track switches, as once thought necessary. But apparently he must still leave his car to telephone at a post, to actuate the block signal switch, to get his lunch pail from a wayside house, and to replace trolley wheels which have left the wire.

10. An automatic oiler suitable for trolley wheels is needed.

11. Some way should be devised of electrically consuming all the zinc in batteries, so that practically no stubs shall remain.

12. An invalid remarked to me that he was obliged to refuse the use of an ozonizer on account of its noise.

13. Can any one explain why the inoperative air-escape valve on steam radiators continues in use? By wrongfully locking in the air, it causes the room to remain cold although there is steam in the pipes. Some electrical engineer may have the needed extra ingenuity for inventing a reliable automatic air-escape valve.

14. Electrically transmitted pictures for illustrating distant news events are now a fact to a limited extent. The fascination of this field lies in an attempt to transmit such visions as readily as the words are carried, even if the apparatus is more intricate.

15. Once the automatic telephone system was declared only theoretically possible; later, the first installation was laughed at; and now it is receiving serious inventive development. Only men who can imagine a hundred things being done simultaneously or in quick succession, should enter this field. It now only needs reduction to simplicity as compared with present apparatus.

16. "Turn-down" electric lamps have not appeared in general use, although many electric-light companies forget, however, that a few million people prefer a small light in their bed-rooms over night.

17. The telephone mouthpiece is certainly more unhygienic than the old public drinking cup, as far as germs, dangerous to the lungs, are concerned. If an acceptable substitute were invented, boards of health would feel called upon to require its use.

18. A watchman's clock is needed that cannot be tampered with by dishonest watchmen.

19. One feature in which the electric vehicle needs to copy the gasoline automobile is in its ability by being able to be charged with electricity as quickly as one can fill a tank with gasoline.

20. There is a market for an invention to render it impossible for the elevator man to start his car until he has closed the door. A proposed device is so complex as to lead to delays.

21. An improved device would be welcome for overcoming the troubles of ice, etc., on trolley wires.

22. An attempt is being made to produce a more practical means of quickly splicing wires.

23. The cord length-adjuster for electric reading lamps in homes and offices, consisting of a ball with holes or slots, is not popular, for a layman dislikes the tedious mechanical operation needed for lengthening or shortening the height of the lamp.

24. Can telephone engineers not invent a more effective way than the "howling" one for calling attention when a telephone has been left off its hook inadvertently. The neglectful individual, it most usually happens, is out of hearing distance.

25. Some simple device that could be operated by any one, as a substitute for hand manipulation in resuscitation cases, would be a valuable adjunct to every central station, for it is next to impossible to remember rules any length of time without the aid of a device for carrying out those rules.

Washington, D. C. Edward P. Thompson.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Preparing the St. Louis System to Receive Keokuk Waterpower

To parallel a local 60,000-kw steam plant with a hydroelectric station 150 miles away is no small task in the case of a city the size of St. Louis. On June 28 the Union Electric Light & Power Company, of that city, synchronized for the first time with the Mississippi River Power Company's plant at Keokuk, and during an initial period of two minutes received 1800 kw from the water-power development. Before thus attempting to operate in parallel with Keokuk the electrical department of the central-sation company had conducted some very thorough tests on the relation of the two systems with a view toward such interconnected operation.

As the system of the Union company was all properly labeled and tagged to show phases and corresponding conductors, the attention of the electrical department was especially directed to the equipment in the new receiving substation (described in these columns May 31, 1913) and to the cables connecting this station with the existing electric-service system.

First of all a test was run on the conductors and sheaths of the latter cables to ascertain the continuity of the feeders, to test for grounds, and also to "phase out." This test was carried out with direct current. The cables were then subjected to a gradually rising alternating-current potential, the maximum value of which was set at the normal working voltage. By this test it was purposed to bring out any faults which might exist in the cables due to faulty insulation or leakages. Finally one end of the cables was connected to the Keokuk receiving substation and the other ends tested out for the proper phase rotation with the generator busbars of the St. Louis company's system.

Three methods were employed in this test in order that there might be no doubt left as to the proper connections. Phasing-out transformers, synchroscopes with lamps, and synchronizing lamps were used. The preliminary tests proved correct and the two systems were successfully paralleled during the short initial period above mentioned —long enough to show that everything was satisfactory.

On June 30 two 12,000-kw 25-cycle turbo-generators at the Ashley Street station of the Union Electric Light & Power Company were operated in parallel with Keokuk from 7:25 a. m. until 11 p. m. During that time from 8000 kw to 10,000 kw was received from the hydroelectric plant at Keokuk. On the following day two turbogenerators were again operated in parallel with Keokuk from 6:05 a. m. until 11 p. m., 15,000 kw being this time received from the water-power station and 9000 kw generated by the steam-turbine unit at Ashley Street. Since that date the Keokuk water-power plant and the St. Louis steam-generating station have been operating in parallel from 6 a. m. until 11 p. m. each day.

From 15,000 kw to 18,000 kw is supplied by the Union company at the present time to the United Railways Company, of St. Louis, during its peak load so that the steam generating equipment which was formerly used to supply this energy may operate at a better load-factor. During the railway company's largest peak load, which comes from 7 a. m. to 8 a. m., all of the transformers which ordinarily supply the Union company with energy from Keokuk are used to furnish the railway company with energy. Similarly during the evening peak load, the railway company is fed entirely from Keokuk. This arrangement is permissible as the Union Electric Light & Power Company is allowed to use energy from the hydroelectric line at any time it desires, as long as the peak load supplied does not exceed 22,000 kw.

Most of the parallel operation up to the present time has been for the purpose of ascertaining what combination of hydroelectric and steam-generated energy will give the most economical operation of the central station in St. Louis. Up to this writing the lighting circuits have been supplied with energy from Keokuk only once since hydroelectric service has been available in St. Louis. Regular service relations with the Mississippi River Power Company will commence Aug. 1.

Rapid Rehabilitation Work at Shreveport, La.

Supplying the business section of a city of 35,000 population with electrical energy for all purposes within six or seven hours after its plant had been almost destroyed by fire was the recent feat of the electrical department of the Southwestern Gas & Electric Company at Shreveport, La. This disaster occurred after the same plant had been partially disabled by another accident a few days before.

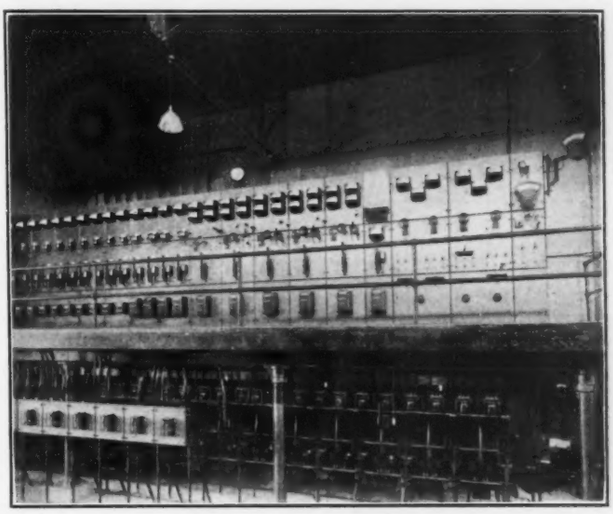


FIG. 1—FRONT VIEW OF MAIN SWITCHBOARD AND 2300-VOLT CONSTRUCTION AT SHREVEPORT, LA.

During the afternoon of Feb. 26 last the station was disabled by the collapse of the structural steel framework of a 60-ft. tile roof covering an extension of the engine room then in course of construction. Fifty-nine men were buried beneath the tons of twisted trusses and crumbled brick and tile of the walls and roof. With the exception of one negro all escaped with only minor injuries. In falling, one of the roof members tore away a portion of the old engine-room wall which had been left standing to shelter the switchboard while the extension was being built. This exposed the board but by next morning a temporary wooden en-

closure had been built around the weather sides, and the plant was placed in operation.

The reconstruction of the extension, designed to house the largest gas-engine set in the Southwest, was at once begun, and was about completed on March 13, when the plant had a second bad-luck visitation, this time by a fire resulting from a short-circuit on the high-tension three-phase motor circuit.

The "short" occurred shortly before seven o'clock in the evening of a wet, dismal day, the flash at the board igniting the temporary wooden shelter, from which the fire quickly spread throughout the engine room, in one corner of which the board was located, putting out of commission all but one of the plant's four generating sets. Three 48-in. belts driving as many generators, two 40-kw exciters and one 400-kw generator were destroyed inside of ten minutes. Altogether the whole fire lasted not more than a quarter of an hour.

The engine room had not cleared of smoke before the local staff "got busy." Hunting up all the scrap belting they could find they managed to splice one of the three belts, which, fortunately, was only half burned; and by three o'clock of the morning of March 14, seven hours after the fire two three-phase motor circuits were working, while by ten o'clock in the forenoon all lighting circuits were in service the demand being met by the one belt-driven generator and a 750-kw direct-connected generator. The latter was the only piece of machinery not affected by the accident.

The only instrument left in the plant was a 300-amp oil switch, and through this and a set of buses installed on two poles set up in the alley adjoining the station the entire city was served. In the meantime a contract had been placed in Dallas for a new switchboard, and new belts were ordered from Chicago. On an emergency order these belts were shipped, received and fitted and the three generators put in service on March 19.

The specifications and drawings of the new board included five 1000-kw generator panels, four three-phase circuit panels, nine single-phase circuit panels, and four exciter panels. The board, illustrated herewith, is of the remote-control hand-operated type and contains modern

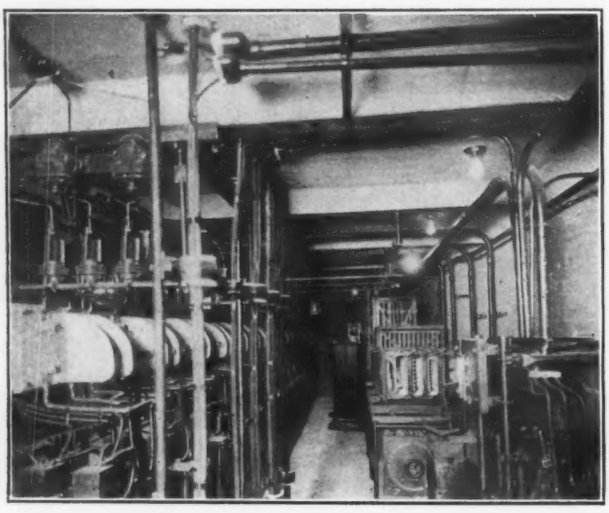


FIG. 2—REMOTE-CONTROL EQUIPMENT ON THE 2300-VOLT CIRCUITS AT SHREVEPORT, LA.

instruments and protective devices, each panel being equipped with indicating and recording wattmeters, alternating-current voltmeter and ammeter and time-relay non-automatic oil switches.

The manufacturer guaranteed to ship the board within two weeks of receipt of complete specifications and drawings, and completed the feat of delivering it f.o.b. Schenectady, April 12, twenty-one days from the date of the order. It was received in Shreveport eight days later, April 19, only thirty-three days after the order had been placed.

No time was lost in setting up the board at the plant and within three months from the date its plant was almost completely wrecked the Southwestern Gas & Electric Com-

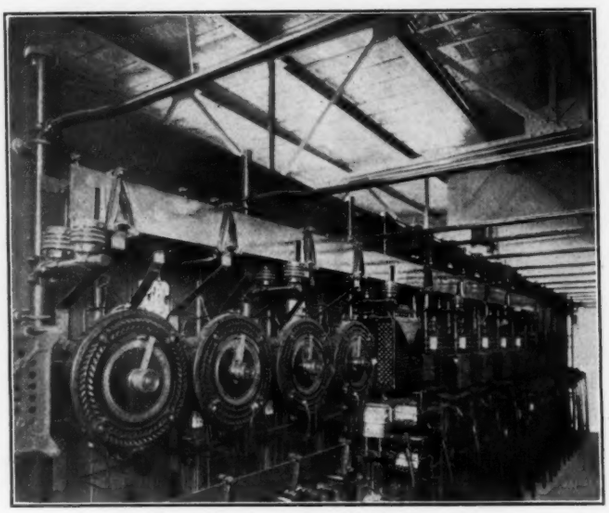


FIG. 3—REAR OF MAIN SWITCHBOARD, SHOWING RHEOSTATS AND REMOTE-CONTROL APPARATUS

pany was giving Shreveport patrons regular and satisfactory service. Mr. J. E. Cowles is superintendent of the electrical department of the company and directed both the emergency relief measures and the rehabilitation work described.

Reliability of Very Large Boilers

In the case of very large boilers such as the 2365-hp units employed by the Detroit Edison Company, are the advantages of higher efficiency and increased simplicity sufficient to offset the proportionately greater chances for breakdown due to failure of some minor part withdrawing the entire boiler from service? O. H. W.

With the big boilers at Detroit test efficiencies of 81 to 85 per cent have been obtained on bituminous fuel, which is probably the most efficient operation ever achieved under practical plant conditions. These 2365-hp Stirling boilers have been drawn upon for outputs equivalent to 10,000 kw and 11,000 kw of turbine load. Ordinarily they are run at from 7000 kw to 8000 kw, being operated in pairs to supply steam to a fully loaded 14,000-kw turbine. After eighteen months' experience at Detroit, the verdict there is that these large boilers are more reliable than the turbines with the latter's numerous auxiliaries, for a small accident to any one of the latter will put the prime mover out of commission. The large double-fired boilers can be operated with the stoker on only the one side, at a decrease of only 40 per cent in output. Boilers, it is added, are not "lost" as quickly as prime-mover apparatus, for possible causes of failure around a boiler can be reduced to a minimum by frequent and painstaking inspection. Of course the tubes nearest the fire are most likely to fail, but an occasional bagged tube can be discovered in the first row by rubbing with the hands at the time of inspection. These have not, however, necessitated shutting down the boilers on emergency calls. Several other companies have used large boilers with success, although the fact that there are, on the other hand, a number of comparatively large stations recently completed or now under construction in which the usual battery of small steaming units has been provided, is evidence that the case of the big boiler is not even yet altogether proved in the minds of all engineers.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

High-Speed Direct-Current Generators.—MAURICE LEBLANC.—The author emphasizes the great progress made in recent years in the manufacture of special steels like nickel steels and nickel-chromium steels which when used in the construction of rotating machinery make possible higher speeds and smaller dimensions. The author first discusses the actual limits of the tangential speeds of rotors and commutators. For the rotor he limits the maximum tangential speed to 120 meters per second, for the commutator to 60 meters per second. He then takes up the construction of machinery of high angular and tangential speed and emphasizes that in order to build a commutator machine with higher angular speed a method of cooling the commutator segments and brushes must be devised which is far more effective than ventilation. The article is to be continued. *La Lumière Elec.*, July 5, 1913.

Power-Factor of Three-Phase Motors.—P. SAUVAGE.—An article illustrated by diagrams on the difficulty of determining the power-factor of a three-phase motor, the different phases of which are unequally loaded in spite of equality of the voltages. In this case the motor has really three power-factors. It is shown that in this case the usual method of calculation yields very inaccurate results. An exact method of determining the three power-factors is given. A suggestion is made that the definition of the power-factor should be revised in the standardization rules of the German Association of Electrical Engineers.—*Elek. Zeit.*, June 19, 1913.

Combination of a Commutator Motor with an Induction Motor.—P. EHRMANN.—The conclusion of his mathematical article illustrated by diagrams on the "operation and the applications of the Leblanc exciter." The author gives the vector diagram of the operation of an induction motor excited by a three-phase commutator motor connected in cascade. Two principal methods of operation are discussed. The author's method permits an easy determination of the slip and the power-factor of the induction motor for any load of the induction motor and for any displacement of the brushes of the exciter. A diagram is given which shows how the use of such a commutator-motor exciter raises the curve which represents the power-factor as a function of the load for various speeds of the exciter.—*La Lumière Elec.*, June 21, 1913.

Undulating Currents.—L. BARBILLION.—The author first gives the general formulas for undulating currents (obtained by the superposition of alternating current over direct current) and then discusses in detail the operation of a direct-current motor by undulating currents. The separately excited motor is first discussed and the series motor is next taken up.—*La Lumière Elec.*, June 28, 1913.

Lamps and Lighting

Flicker Photometer.—H. C. STEVENS.—Lord Rayleigh has suggested the possibility that the "physiological process" which affords the common basis by which colored and uncolored lights are measured by means of the flicker phenomenon, is the iris, or the contraction of the iris when exposed to bright light. From this viewpoint the flicker adjustment would be complete when the iris has no tendency to alter under the alternating illumination. This hypothesis is susceptible of an experimental test. By the simple expedient of paralyzing with atropin, an iris is secured which is entirely immobile in the presence of lights of different intensities. If the flicker phenomenon persists in an eye with a paralyzed iris, obviously some other physiological process must be sought as the cause of the phenomenon. An experiment was made in which the irises of both eyes of the author and those of C. D. Livingstone were paralyzed with a solution of homatropine sulphate. When the pupil ceased to change in size with changing intensities of light, the flickering fields was observed through the tube of their apparatus with each eye separately, the rate of the motor which caused the flicker to disappear was determined. Under these conditions the appearance of the flicker was not changed in any observable particular from the appearance of the flicker to the normal eyes. All degrees of flicker remained as before the atropine was placed in the eyes, and it is to be noted also that the disagreeable quality of the coarse flicker persisted undiminished. Moreover the numerical results obtained for each eye and for each observer agree very well among themselves.—*Philos. Mag.*, July, 1913.

Storage Battery Lighting of Railway Trains.—WILCKE.—The pure storage battery system of lighting railway cars is now finding continually increasing favor with the Prussian railways. Each car is equipped independently with a storage battery, which is recharged at charging stations provided at intervals. The equipment of each car, the arrangement of the charging system, and the equipment of the charging stations are discussed. It is emphasized that with this system the light is uniform without any fluctuations. The manufacture of metallic-filament lamps has made so much progress that the constant vibration of the car affects neither the uniformity of the light nor the life of the lamps. With the careful equipment chosen there is no danger of short circuits. The careful treatment which the storage batteries need is assured since on each charging station the batteries are handled by expert attendants, their behavior is observed during charging, and the condition of the acid is tested.—*Elek. Kraftbet. u Bahnen*, June 24, 1913.

Generation, Transmission and Distribution

Large High-Tension Networks.—AUGUST PETRI.—In three-phase stations a power-factor of 0.8 is usually assumed and when the power plant of Belgard was erected, which supplies energy over a very large agricultural district, it was assumed that a power-factor of 0.7 would be normal. The length of the lines first erected was 1000 km (600 miles). When the transmission line was extended the situation changed completely so that as a result of the capacity of the 15,000-volt line of 1830 km (1100 miles) and of the 43,000-volt line of 120 km (72 miles) the load factor is now not less than 0.8 during the day. Usually it is about 0.9 and increases to unity for a certain load, decreasing again when the load increases further. Control measurements showed that this result is due to the capacity of the long transmission line and not to any errors of measurements. In the same plant the earth current in the case in which one phase is earthed was measured. The measurements were made for different lengths of the line and with the increasing voltages. The results are given in Fig. 1. For the whole network of 15,000 volts with a

length of 1800 km (1080 miles) the earthing current was 78 amp. This is of importance to decide the question whether the automatic circuit breakers will immediately operate when a line should break and fall on the earthed protective ring. The circuit breakers in the plant in question operate at 36 amp, so that according to the diagram the circuit breakers will operate with certainty if 800 km (480

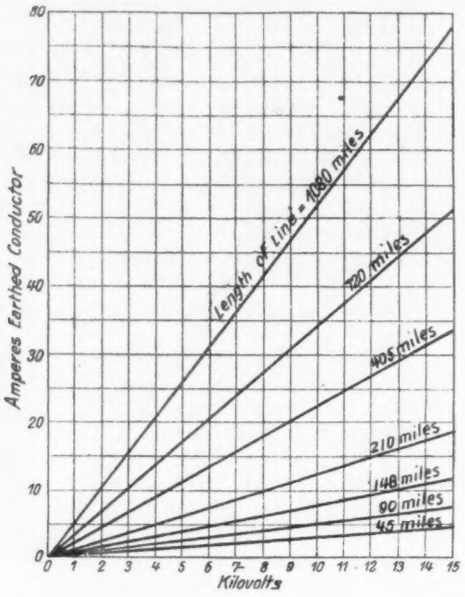


FIG. 1—EARTH CURRENT WITH ONE PHASE GROUNDED

miles) are connected. Further experiments showed that whether the earth resistance is greater or smaller, is of little importance for the earthing current.—*Elek. Zeit.*, June 19, 1913.

Sectionalizing Devices for Central Stations.—F. Heppenstall.—The author thinks that to take care of the two opposing problems of reliability of supply and low cost of operation in central stations some system of sectionalizing should be applied, and describes various systems for this purpose.—London *Electrician*, June 20 and 27, 1913.

Exhaust Steam.—F. L. Richter.—An illustrated article on the utilization of exhaust steam in turbines.—*Elek. Zeit.*, June 19, 1913.

Traction

Direct-Current Shunt Motors for Mountain Railways.—Reutener.—In order to recuperate energy in running down grates, the Prussian State Railways made experiments some years ago with motor cars operated with a direct-current shunt motor, but the results were not satisfactory largely on account of difficulties of speed regulation, etc. The Siemens-Schuckert Co. has worked out a new system with a compound motor on a motor car which permits satisfactory recuperation of energy down grades. The feature is the use of a single compound motor in connection with storage battery, the two halves of which are operated in series of parallel. Eight of the fourteen controller positions are for parallel operations and six for series operation. The four-pole compound motor has four commutation poles, the windings of which are supplied with the armature current. The shunt winding is divided into two parts and each half is connected to one-half of the battery. The motor has a rating of 230 hp and is air-cooled. Not only recuperation of energy is possible but there are other advantages on mountain roads. For every position of the controller the speed is practically independent of grades or curves. This permits a very exact formulation of the schedule and of exact rules as to the controller positions to be used on the different portions of the road in order to maintain the schedule and obtain economy of operation. Details are given of operation on a line near Limburg. The conclusion is that on mountain roads the system is superior to the standard direct-current series-motor system.—*Elek. Kraftbet. u. Bahnen*, May 14, 1913.

Storage Battery and Gasoline-Electric Motor Cars.—Weyand.—A long review of the trials which have been carried out with motor cars of three different types on the Prussian-Hessian railways. The first type was for operation with steam, the second for operation with storage batteries, and the third for operation with gasoline engines and electric transmission. The steam cars have not proven satisfactory. The storage battery cars have proven very successful and reliable though they have some disadvantages. Data are given on the maintenance of the batteries and the expense of the storage battery operation during a whole year. The system may be further developed by extending the limit of the operation of the cars with one charge by building larger and also lighter batteries. The erection of charging stations at the correct place is very important as is also their proper equipment for easy charging. The gasoline-electric motor cars have freedom from smoke in common with the storage-battery cars and are greatly superior to the latter in their almost limitless range of operation, since they are practically independent of charging stations. Nevertheless they are not yet as satisfactory as they could be. The reliability which has been the most remarkable feature of the success of the storage battery cars is not yet as great for the gasoline-electric cars which require far more intelligent maintenance and attendance than the exceedingly simple storage battery cars. In commercial respects the gasoline-electric car seems to be superior to the storage battery car, although this is not yet certain in view of the rising price of gasoline. All the doubtful technical points have to be decided by experience with some new gasoline-electric cars to be placed in operation in the near future.—*Elek. Kraftbet. u. Bahnen*, May 4 and 14, 1913.

Electrification of Main Railways.—W. Reichel.—A review of progress of electrification during the last year. The author concludes that the direct-current system will be reserved for railroads of short length and dense traffic. This system does not seem to be advisable for heavy trains because the current-collecting device can handle hardly more than 300 kw continuously or 500 kw for short periods, while heavy-traction systems require from 3000 to 5000 kva. The three-phase traction system has not been introduced to any great extent outside of Italy. Diagrams are given showing very rapid extensions of the single-phase traction system and its suitability for heavy traction in general. Above a certain limit of weight of train and a certain limit of capacity of a single-phase traction system locomotives are superior in operation to motor-cars because the electric equipment of the motor-cars becomes too complicated and heavy. The article contains concise reviews of recent installations in different countries.—*Elek. Kraftbet. u Bahnen*, Feb. 24, April 14 and June 14, 1913.

Single-Phase Traction in Spain.—Wagenknecht.—An illustrated description of the interurban railway from Pamplona to Sanguesa, which is the first single-phase railway of Spain. The energy is supplied from a water-power station containing two 500-hp turbines, the single-phase current being generated at 6600 volts and 25 cycles. The voltage on the trolley wire is 6000, but through the City of Pamplona it is only 600 volts. Only motor cars are used which have been built partly by a Spanish and partly by a German company. In the former Latour single-phase motors are used, while in the latter use is made of single-phase motors of the Winter-Eichberg type.—*Elek. Kraftbet. u. Bahnen*, June 14, 1913.

Electric Traction in Saxony.—A report of the memorial of a government department of Saxony on the possibilities of introducing electric traction on the state railways of Saxony. From a comparative discussion of electric trac-

tion with other traction systems it is concluded that wherever cheap coal or water-powers are available and were traffic is heavy electric traction can compete successfully with steam traction. This is especially true for city and suburban lines if the traffic has developed to a certain extent. In Saxony this is especially true for Dresden and Leipzig. The whole third chapter of the memorial is devoted to a discussion of electric traction in the city and suburbs of Dresden.—*Elek. Kraftbet. u. Bahnen,* June 24, 1913.

Installations, Systems and Appliances

British Municipal Electrical Association.—The annual report of the council of the Incorporated Municipal Electrical Association of Great Britain. The membership is now 386. Parts of the report deal with the rating of metallic-filament lamps, a proposed electric lighting bill for England, the standardization of the conditions of contract, and a proposed change in the constitution of the council.—London *Electrician,* June 27, 1913.

Testing of an Oil Switch.—M. VOGELSANG.—An illustrated English translation in abstract of his German paper noticed sometime ago in the *Digest* on a test at a Norwegian power station of a three-pole, 20,000-volt, 200-amp oil switch.—London *Electrician,* June 27, 1913.

Electrophysics and Magnetism

Resonators for Short Electric Waves.—W. S. NELMS AND W. L. SEVERINGHAUS.—An account of a systematic study of linear and non-linear resonators for short electric waves. The object was to determine the relation of the dimensions and distribution of the resonators to the resulting wave-length. The "multiple reflection method" (see *Digest* last week) was employed. A summary of this investigation follows: A change in the distance between the resonators measured along the direction of the electric oscillation has very little effect on the period of oscillation of the resonator. This applies to both linear and non-linear resonators. For a screen of resonators the ratio of the wave-length of the energy radiated to the length of the resonators depends very largely upon the separation of the resonators measured perpendicularly to the electric oscillation. The value of this ratio is given in curves which may be used to determine the proper distribution of resonators to give any desired wave-length. The effect on the wave-length of the distance between the resonators measured perpendicular to the electric oscillation is more simply expressed in terms of the center-to-center distance between the resonators than in terms of the side-to-side distance. An increase in the width of the resonators of a given length has a very small effect on the wave-length re-radiated. An increase in the width of the resonators increases the damping of the oscillation. As a result the interference curves are irregular and the oscillation shows a more marked tendency than in the case of the linear resonators to correspond to that of the first overtone. For widths greater than one-fourth of the length of the resonator, the energy decreases with an increase in the width. If the width of the resonators be greater than 1.5 times the length, there is very little effect of resonance. The wave-length of the energy from the screen is determined almost entirely by the wave-length of the incident energy. The ratio of the wave-length to the resonator length for a resonator not under the influence of other resonators has been shown to be greater than 2. The value estimated from this investigation is about 2.4. It appears from the results of this investigation that any resonator having a width less than one-fourth of its length may be taken as a "linear resonator." If the ratio be greater than this there is only a small change in the wave-length but a marked change in the character of the re-radiated energy.—*Phys. Review,* June, 1913.

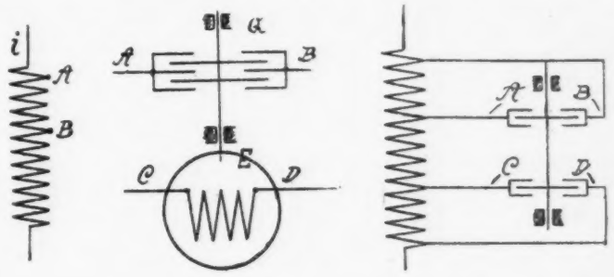
Resistance of Graphite.—D. E. ROBERTS.—An account of an experimental investigation of the effect of temperature and magnetization on the resistance of graphite. The author gives theoretical considerations which lead one to suspect a very large effect of this kind. The results of his experiments confirm this view. For instance, in experiments at ordinary temperature with different specimens of Ceylon graphite. The increase in a transverse field of 20 kilogausses varied between 300 and 500 per cent of the resistance in zero field.—*Philos. Mag.,* July, 1913.

Energy Required to Ionize an Atom.—R. T. BEATTY.—The energy required to ionize an atom, that is, to detach an electron from an atom, is a quantity of importance in checking theories of atomic constitution. This calculation can be made if the number of electrons in the outer ring and the atomic radius are known. This is the case for the gases of the helium group, and the author shows that for the gases helium, neon and argon, the ionizing potentials calculated from his theory agree closely with the values observed.—*Philos. Mag.,* July, 1913.

Units, Measurements and Instruments

British Physical Laboratory.—An account of the opening of the new buildings of the (British) National Physical Laboratory. The laboratory was opened in 1901, and the new buildings just opened comprise a building for metallurgy, laboratories for optics, and a central block for administrative purposes, with the section where the receipt and discharge of instruments for tests will be dealt with.—London *Electrician,* June 27, 1913.

Measuring Frequency.—MANDELSTAM AND PAPALEXI.—An illustrated description of an instrument for measuring



FIGS. 2 AND 3—CONNECTION DIAGRAMS

the frequency of a wireless telegraph current, the measurement being independent of the damping and the amplitude of the current. The current i to be measured passes through the conductor A B in Fig. 2. If the effective voltage between A and B and effective current are measured the ratio of effective voltage to effective current depends on the frequency, the ohmic resistance, and the self-induction of the conductor A B. If the instrument is connected to the same points A and B, the self-induction and the ohmic resistance remain constant and the reading depends only on frequency. An instrument of this kind may consist of a quadrant electrometer Q coupled with an electrodynamometer E so that they have the same axle of rotation. The electrical connections are so made that the two instruments tend to revolve in opposite directions. The deflection depends on the ratio of effective voltage to effective current. The quadrants of Q are connected to points A and B while the current A B passes through the movable coil C D. Of course, C D may be connected to a shunt. Another method of determining the frequency is shown in Fig. 3, in which the instrument is a combination of two electrometers A B and C D, having the same axle of rotation. The two pairs of quadrants are connected to four different points of the coil through which the current under test passes and the electrical connections are so made that one electrometer tends to rotate in a direction opposite to that of the other. The resulting deflection will depend on the ratio of the voltages impressed on A B and C D. The resulting deflection of the needle depends only on the frequency. The same instrument may, of course,

also be used to measure self-inductance if the frequency is kept constant.—*Zeit. f. Feinmechanik,* April 20, 1913.

Electric Measurement of Gas Velocities.—The method of R. Goldschmidt for measuring wind velocities depends on the comparison of the temperatures of two identical wires A and B. In Fig. 4 the wire A is suspended from a mast M and is subject to the wind the velocity of which

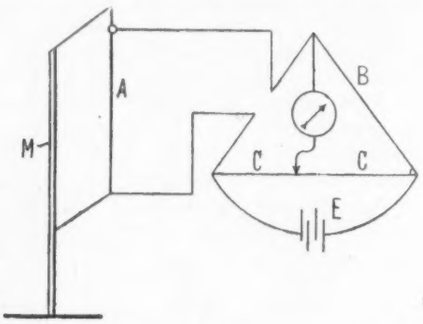


FIG. 4—INSTRUMENT FOR MEASURING GAS VELOCITIES

is to be measured. The wind has a cooling effect on this wire. The wire B is protected from the wind. The temperature difference of the two wires is a measure of the wind velocity. To measure the temperature, a resistance measurement is used with the two wires A and B being connected as two arms in a Wheatstone bridge which also contains the slide wire C C and the bridge containing the galvanometer. The cooling effect of the wind disturbs the equilibrium of the bridge and the wind velocity may be found either from the deflection of the galvanometer or from the displacement of the contact of the slide wire required to bring the reading of the galvanometer back to zero. O. Bordoni has recently investigated this method and applied it also to the measurement of low gas velocities. In his experiments the contact of the slide wire was adjusted to bring the galvanometer needle to zero position. If L is the position of the sliding contact with zero current in the galvanometer and both wires A and B cool, then if the wire A is heated, the position of the sliding contact must be changed to L′ to reduce the galvanometer again to zero. If now the temperature of A is again changed due to the cooling effect of the wind or of a current of gas the sliding contact requires another adjustment, say, to L″. The difference in the positions of the sliding contacts is found to be proportional to the temperature difference. The difference L L′ relates to the condition of air or gas at rest. The difference L L″ relates to wind or the passage of a gas current. The slide wire may be calibrated directly in air or gas velocity. For slow velocities of gas currents it is best to use a thick, bright, loose wire, 0.1 to 0.2 mm thickness. For higher wind velocities a tightly stretched thicker wire blackened on the surface is preferable.—*Zeit. f. Feinmechanik,* May 20, 1913.

Air-Gaps in Moving Coil Instruments.—C. G. Garrard.—The author first gives a formula for the torque experienced by a wire carrying a current in the field of a permanent magnet. He then discusses the method of magnetizing permanent magnets and the maximum value of magnetization which can be obtained. He emphasizes that the maximum number of magnetic lines which can be got through the magnetic circuit depends almost wholly upon the character of the steel and the cross-section of the magnet, and not upon the shape or size of the narrow air-gap of the instrument. He discusses the parallel arrangement of air-gaps and shows that, with equal magnets, the density in the air-gap of the parallel arrangement is half that in the series arrangement (assuming the air-gaps equal in area). Therefore the effect of exterior fields is double in the parallel-gap instrument and the working field is one-half. He finally discusses the method of aging permanent magnets by demagnetization with an alternating current and additional mechanical vibration treatment.—London *Elec. Review,* June 27, 1913.

Telegraphy, Telephony and Signals

Wireless Detectors.—W. H. Eccles.—An abstract of a (British) Physical Society paper on electrothermal phenomena at the contact of two conductors. The paper which is purely theoretical deduces mathematically the laws connecting the current and the applied emf in a circuit containing a light contact of two conductors. When an electric current passes across a light contact of two different substances, heat is liberated or absorbed in accordance with the law of Peltier and is generated in accordance with the law of Joule; in the regions of the conductors where there is a temperature gradient, heat is liberated or absorbed in accordance with the "Thomson effect." These thermal actions are very noticeable in contacts made of badly conducting natural oxides or sulphides on account of the high resistivity and the large thermo-electric effects in these substances. The low thermal conductivities of these substances exalt the electrical consequences by conserving the heat. It is shown that, in general, when a contact is used as a radio-telegraph detector, there may be some coherer action mixed up with the thermo-electric "rectifying" action; and that whether there is or there is not any coherer action, the principal features of the characteristic curve connecting current and emf are determined by the Thomson rather than by the Peltier effect. Thus if two contacts could be made having all their electrical and thermal properties of equal measure excepting the Thomson property of which the measures were of opposite signs, the curve connecting current and emf for one contact would rise more rapidly on, say the side of positive emf than on the side of negative emf while the reverse would be true for the other contact; a direct experiment of applying heat to the contacts in turn and observing the consequent thermo-electric forces, showed these to have the same direction in both.—London *Electrician,* June 27, 1913.

Wireless Detector.—R. Moretti.—A description of a new detector for electric oscillations based on the same principle as the electrodynamometer of Arno, namely, the change of hysteresis, due to electric waves, in an iron or steel piece in a variable magnetic field.—*Elettriciste,* Feb. 15, 1913; abstracted in *Zeit. f. Feinmechanik,* May 20, 1913.

Wireless Time Signals.—E. de Longueval.—A detailed article on the transmission of time signals from the wireless station of the Eiffel tower in Paris.—*La Lumière Elec.,* June 28 and July 5, 1913.

Book Review

Resuscitation. By Charles A. Lauffer, M.D. New York: John Wiley & Sons. 47 pages, illus. Price, 40 cents.

This book includes a reprint of a paper on resuscitation read before the Philadelphia Section of the National Electric Light Association by the author, who is medical director of the Westinghouse Electric & Manufacturing Company. After explaining a number of successful results which have been obtained from employing resuscitation methods on men who were supposedly dead, the author gives a clear description of the mechanism of respiration, a number of views of the various parts of the anatomy being used for illustrative purposes. The prone-pressure, or Schafer, method of resuscitation, which has been adopted by the National Electric Light Association and a number of other engineering societies, is described in detail. The author brings out in a clear, concise manner the necessity of people in general being versed in the principles of resuscitation.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Self-Tightening Cable Clamp

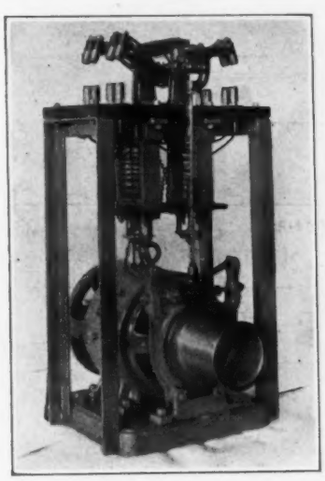
The accompanying illustration shows a new self-tightening cable clamp for dead-ending and supporting power cables. By the ingenious lever construction of this clamp the cable is gripped with a force proportional to the tension applied. Being boltless, it can be attached in a minute, holds the tighter the greater the strain imposed, and can be

BOLTLESS CABLE CLAMP

removed quickly as soon as tension is released. When dead-ending power cables with these clamps, the insulation is first removed from the cable for a distance of 5 in., after which the clamp can be attached in one-fifth the time of the old methods, and without soldering. Sharp turns and difficult adjustments are rendered easy with this cable clamp. The clamp is built to withstand strains of 10,000 lb. and for cables of 250,000 to 1,000,000 circ. mil in cross-section, the manufacturer being the Automatic Cable Clamp Company, Donora, Pa.

Direct Drive of Dumb Waiter Elevator Mechanism

Friction in the worm-gear drive of elevator mechanisms constitutes a considerable portion of the total power loss incident to the electric-motor drive of this class of machinery. The illustration herewith shows the installation of a 0.5-hp, 500-volt, 160-r.p.m. steel-frame motor driving the mechanism of a small dumb-waiter. In this case the drum carrying the cable is mounted directly upon an extension of the armature shaft. The drum is about 4 in. in diameter. The entire installation occupies a small space as the switches and starting resistors are mounted on a frame which is made part of the motor base by angle-iron framework bolted to the bedplate. The brake is applied directly to the drum.



MOTOR AND CONTACTORS

The motor illustrated was made by the Diehl Manufacturing Company, Elizabeth, N. J.

Improved Plug Attachment

A plug attachment which is particularly well suited for use with electrical household devices has recently been brought out by the Tregoning Electric Manufacturing Company, 418 West Prospect Street, Cleveland, Ohio. This attachment is so designed that in case undue strain is brought to bear on the cord connection between the outlet and the device the plug attachment will be released from the outlet, thus lessening the danger that the break will occur in some other place or that the portable device will be injured by an accidental fall. The plug attachment is also fitted with a so-called "anti-knot feature" so that the conductor cord may be turned or screwed into the composition cap and need not be knotted on the inside as is the usual practice. It is stated that this method of fastening the cord saves an inch of cord on each connection and prevents frayed edges and wear to a great extent.

PLUG ATTACHMENT

Pulley with Protection from Rain and Sleet

The long enclosing case of the pulley illustrated herewith forms a covering to keep the rain and sleet out of the interior of the device. The guide ridges are cast as an integral part of this casing. The rounded edges of the rope clamp keep the rope from being damaged by the sides of the pulley. When the pulley and hanger are in the position shown all of the strain is relieved from the rope and the weight is taken by the safety knob, which is supported by the enclosing case.

PROTECTED PULLEY

These pulleys are made with five standard types of top

clamps for suspension from mast arm, outrigger, ceiling or span wire by the Line Material Company of South Milwaukee, Wis.

Improvements in Induction-Motor Design

The use of pressed steel in motor construction represents an advance in motor design. As this material imparts mechanical strength and is uniform in structure, a motor of a given weight can be made with more active material than motors in cast-iron frames.

In all sizes the rotor bars are insulated with cement

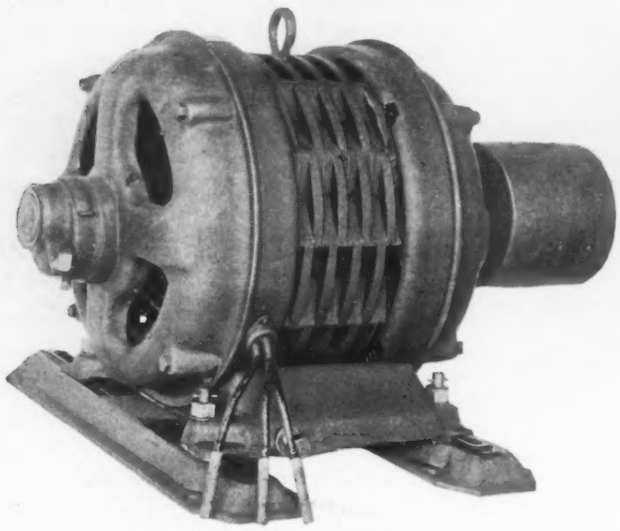


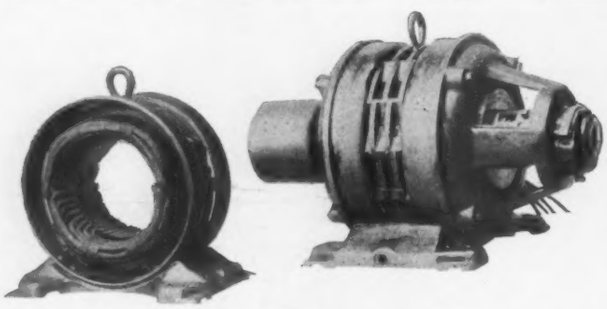
FIG. 1—MOTOR WITH CAST-STEEL FRAME

which is moisture resisting and will withstand a high degree of heat and mechanical stress.

The bearings, being the only wearing parts, are protected from dust by a cap on the front end and by felt washers between metal rings on the pulley end. It is said that the efficiency and power-factor are high, not only at full load but at fractional loads also.

The motor shown in Figs. 2 and 3 is of the repulsion-starting type and when up to speed, runs as an induction motor. For most applications, it can be connected directly to the line, but where very low starting current is desired a starting rheostat can be used.

The bearings and frame are of the type described above. The rotor coils are form-wound and arranged to permit



FIGS. 2 AND 3—SMALL REPULSION-STARTING TYPE MOTOR

good ventilation. The commutator is of the radial type with undercut mica segments. The shaft can be pressed out of the rotor without disturbing the windings or the commutator.

These motors are being made in sizes ranging from 2 hp to 10 hp and can be arranged for operation on either 110-volt or 220-volt circuits. Both of these lines of motors are products of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Batteries for Starting, Lighting and Ignition

Two types of storage batteries in which the active material in the positive plates is said to be very hard, dense and closely bound are now being put on the market for use with gasoline automobiles by the Gould Storage Battery Company of 18 East Forty-second Street, New York City. The advantages claimed for the hard paste composition used in these batteries are resistance to wear, retention of full rating and elimination of damage due to jarring and vibration. It has been the aim to proportion the material in the

STORAGE BATTERY FOR AUTOMOBILES

negative plates so that any tendency toward shrinkage will be automatically offset during the life of the plate. The group of cells in hard-rubber jars is inclosed in a hard-wood box and the terminals are designed so that leakage of the acid and consequently corrosion of the terminals will be avoided.

Electric Trucks in Freight Pier Service

On the marginal street along the west side of Manhattan Island much annoyance and expense to merchants are caused by delays to teams and trucks carrying merchandise to the waterfront for shipment on outgoing vessels. At Piers 14 and 15, North River, used by the Fall River and

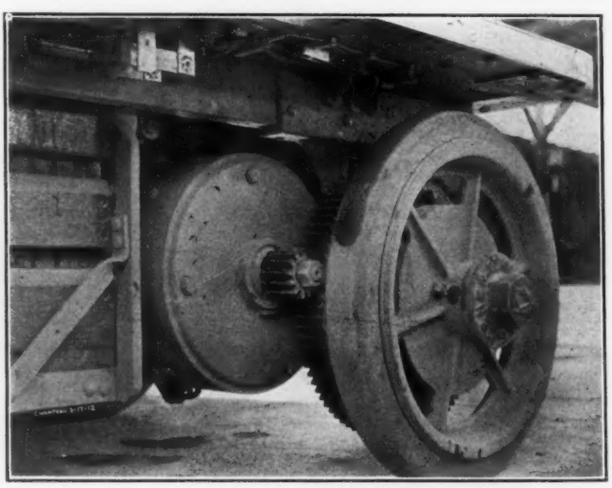


FIG. 1—MOTOR PINION AND GEAR

Providence Steamship Companies' lines a very successful attempt to relieve this congestion is being made. The method adopted consists of using a receiving platform across which the incoming freight is unloaded from the wagons and quickly loaded upon electric trucks, which are run directly to the vessel receiving the freight.

One of the distinctive features of the trucks is the single

reduction gear shown in Fig. 1. The pinion on the end of the armature shaft meshes with a gear bolted to the wheel and both the pinion and the gear are enclosed in gear cases which are partially filled with lubricant so that the gears constantly operate in oil. There is no differential, no countershaft and no chain. The trucks now being used at the pier of the Fall River Line are equipped with two

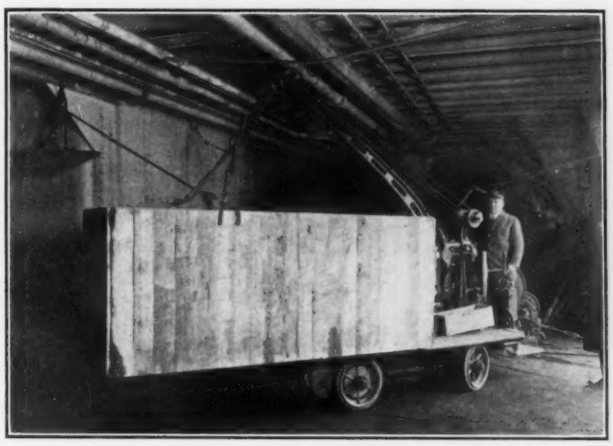


FIG. 2—AN UNWIELDY BOX HANDLED BY CRANE TRUCK

motors and will successfully climb a 28 per cent grade when fully loaded. Grades approximating the above figure are met with in pier service at high and low tides, otherwise a single motor truck could successfully perform the work. It is said that single motor trucks will climb a 20 per cent grade.

Electrical energy for operating the trucks is furnished by a 44-cell lead storage battery suitable for charging directly from 115-volt direct current circuits. Each cell has a 48-amp-hour rating and the battery will deliver 85 volts on discharge. The motor is of the series type and is wound to take 10 amps at 85 volts. The maximum speed of the truck fully loaded is 7 miles per hour.

A so-called electric loader intended to lift and carry on its own platform merchandise weighing a ton or less, to load other trucks of either the hand or the electric type with heavy freight, to load and unload delivery wagons and

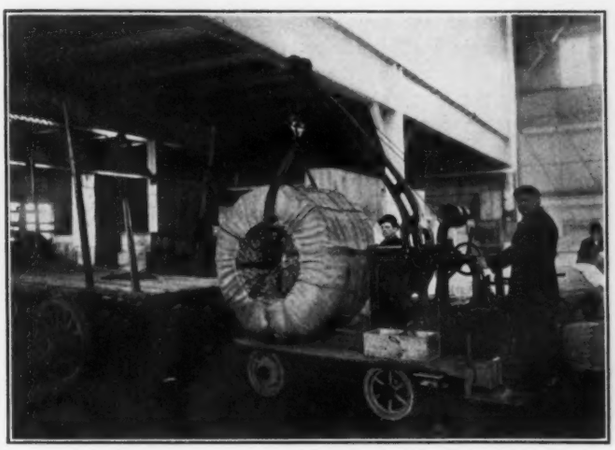


FIG. 3—SELF-LOADING TRUCK UNLOADING BALE OF ROPE

to pile and tier freight, is also being used on these piers. The platform of this crane truck is low so that it can be run under the body and axle of the ordinary delivery wagon, and the height of the boom in the lowest position permits the machine to be run through doors in the ordinary freight house or through the side ports of covered barges or steamboats. The boom does not swing, but the truck can be turned in a radius of 13 ft. giving the same effect as though the boom was swung by a motor. The quadrant can be raised or lowered by an electric motor, the time required for the complete movement being about 11 seconds.

In its highest position the hoist line is directly over the middle of the platform. When carrying a full load of 1

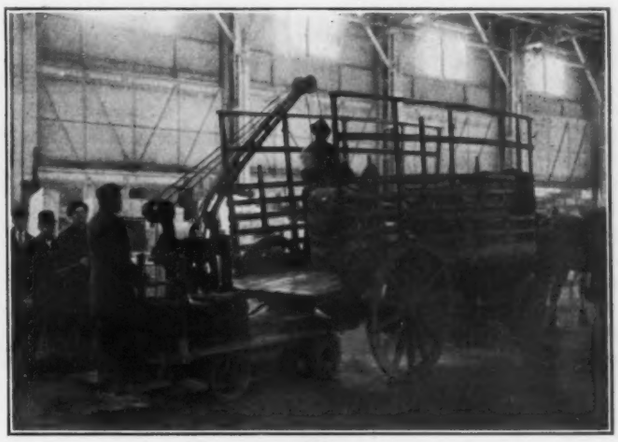


FIG. 4—CRANE TRUCK WITH PLATFORM UNDER WAGON AXLE

ton the maximum speed of this vehicle is 7 miles an hour. The crane hoist will lift a weight of 1 ton at the rate of 40 ft. per minute. The truck is 10 ft. in length, 4 ft. wide and the platform stands 21.5 in. above the floor. The quadrant has a range of 7 ft. being at a height of 15 ft. from the floor in its highest position and 8 ft. from the floor when at its lowest extreme of travel. The storage battery consists of 44 lead cells of 70-amp-hours rating each and the energy from this battery drives two series motors rated at 10 amps, 85 volts. The motors on this electric loader are geared directly to the driving wheel as are those in the smaller trucks. The weight of the empty vehicle is 4500 lb. and the truck is said to be able to climb a 20 per cent grade either when empty or loaded.

The operation of the electric trucks at the Fall River Line and Providence Line piers have been highly satisfactory to the patrons of the line and to the management.

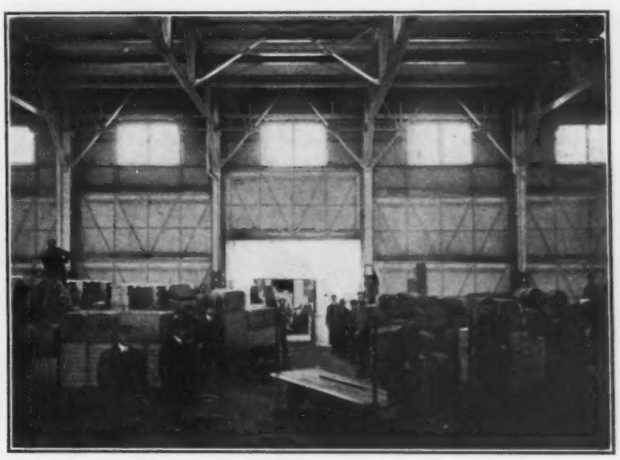


FIG. 5—BATTERY TRUCK ON PIER 14

Freight is now received at the platforms extending along the entire street front of piers 14 and 15. This method of handling freight has reduced to a minimum the time required to discharge teams, resulting in economies not only to the steamship company but also to the shippers. As yet no authentic operating cost data have been prepared, but the management of the steamship company is satisfied from

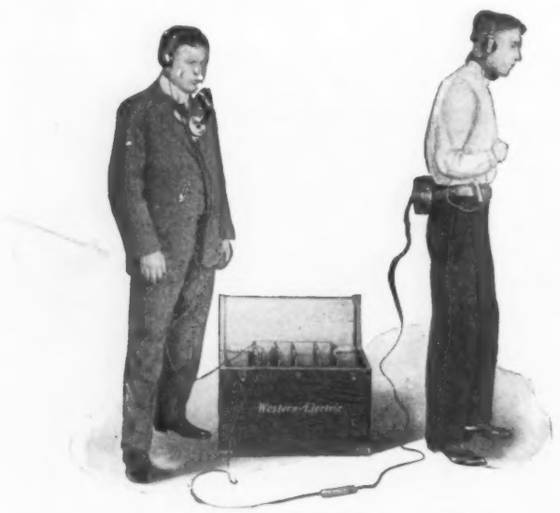
the preliminary investigations that the balance will be in favor of the electrical equipment.

Both the trucks and the electric loader are the products of the Sprague Electric Works of the General Electric Company, New York City.

Telephone Equipment for Mine Rescue Work

There are a number of special points to be taken care of in the design of telephone equipment for mine rescue work which do not arise in any other service for which similar apparatus is used. In the first place, the members of the rescue party invariably have to wear oxygen helmets, because of the presence of poisonous gas in the mine, and this prevents the use of the ordinary type of transmitter. Moreover, the rescue party is apt to be encumbered with tools and stretchers and any additional equipment carried must be made absolutely as light and compact as possible. Finally, the wires which connect the rescue party with those at the mouth of the mine or other vantage point must be light and durable and absolutely waterproof in order to stand the rough handling and moisture encountered in this service.

Working in conjunction with the federal bureau of mines and from a broad experience gained through supplying numerous regular mine telephone installations during the past few years, the Western Electric Company has finally developed a light, simple and serviceable equipment for use in mine rescue work. The details concerning this apparatus are noteworthy. In place of the ordinary type of mouthpiece a "throat" transmitter has been produced, which, it is claimed, works practically as well as the standard mouthpiece instrument. A single-piece receiver is used and the combination instrument when strapped onto the operator's head takes up hardly any room. The connecting cable consists of two copper wires insulated with black enamel and two layers of silk, the whole being wound with stout linen braid and impregnated with a moisture-resisting compound. A 500-ft. coil of this wire is carried in a case strapped to the back of the operator's belt and arranged to pay out automatically as the rescue party advances. The total weight of the apparatus carried by the operator is slightly over 5 lb.



EMERGENCY TELEPHONE EQUIPMENT

At the other end of the line are the battery box and auxiliary supply of cable, together with a standard switchboard operator's set, consisting of a chest-type transmitter and head-band receiver. The entire outfit has been designed and built with the single object of providing a practical and durable equipment for this special work.

Lighting Equipment for the City of Niagara Falls

The city of Niagara Falls will be one of the first in the United States to adopt the double-bracket combination lamp and trolley pole. In the near future Falls Street between Riverway and Fourth Street and North Main Street between Michigan Avenue and North Avenue will be illuminated with units such as the one shown in the accompanying illustration. The poles will be spaced 70 ft. apart with two lamps on each pole, one extending over the roadway and one over the sidewalk. The sixty poles which will be erected on Falls Street and the fifty-four poles which will be installed on Main Street will take the place of the present iron trolley poles and will become the property of the city.

COMBINATION LIGHTING AND TROLLEY POLE

In order to avoid slotting the poles at the ground line, thus weakening them at the point of greatest strain, the cut-outs have been placed as shown in the body of the ornamental fixture. The small ring suspended by a short chain is the only outward evidence of the cut-out. By using a small hooked rod the operator can light or extinguish the lamp from the sidewalk by pulling the chains. The chains are insulated from the current-carrying parts to obviate danger of leakage at this point.

The poles and the ornamental fixtures will be furnished by the Electric Railway Equipment Company, of Cincinnati, Ohio, and the inverted magnetite arc lamps will be supplied by the General Electric Company, of Schenectady, N. Y. Energy for the operation of the lamps will be furnished free by the Hydraulic Power Company and the Niagara Power Company, and will be distributed without charge by the Niagara Falls Electric Light & Power Company.

Noiseless Gasoline-Electric Vehicles

The problem of transmission of torque from the gasoline engine shaft to the driving wheels of a vehicle has been perplexing automobile engineers since the first motor vehicle was designed. Even to-day as the heavy 5-ton and 7-ton truck rushes over the highway, its clutch and transmission buzzing in a manner which makes the noise of a honking horn weak in comparison, it is apparent that there is still much left to be desired in the way of noiseless drive.

In a paper presented by Mr. T. B. Browne, president of the British Institution of Automobile Engineers, before the Society of Automobile Engineers in New York, a description of the London omnibuses was given. Mr. Browne said in substance that the two main factors which have principally conduced to the present efficiency of the gasoline

omnibuses now running on the London streets, are the insistence of the police authorities that the vehicles comply with a high standard of noiselessness and reliability and the determination of the constructors to produce vehicles capable of passing these tests. As an example of the difficulty of passing the police inspection of these vehicles it may be mentioned that cases have been known where vehicles have failed to obtain a license to run solely on account of the hissing noise caused by the passage of the air through the carbureter inlet.

There are about 120 gasoline-electric motor omnibuses running in London in which the transmission from the engine to the worm-driven live axle is accomplished by means of an electrical set, consisting of a compound-wound generator directly coupled to the engine and a series-wound motor coupled through a cardan shaft to the worm. The generator is connected to the engine by means of a flat leaf spring coupling, no friction clutch being used. No electric circuits are made or broken when driving, as the generator is designed so that the field coils are unexcited when the engine speed falls below 300 r.p.m. Thus by nearly closing the throttle the torque of the motor is reduced to zero.

The generator is capable of a maximum output of 20 kw at a speed of 1400 r.p.m. with a maximum emf of 300 volts. The control is effected entirely by the gas throttle pedal, except when ascending very steep hills, in which case a shunt resistor contained in the controller box is employed to allow of increased engine speed.

The generator and motor are of the semi-enclosed type and are ventilated by a disk fan carried on the rear end of the generator shaft. The efficiency of the generator is stated by the makers to be 90 per cent, and that of the motor 88 per cent, the resultant efficiency of the electrical set being 79.2 per cent.

The average running costs of these vehicles is said to be just over 14 cents per mile. This figure includes all cost of running, maintenance, tires, drivers, gasoline, lubricating oil, grease, paraffin, lighting, depreciation, rent, rates and taxes, conductors, body upkeep and traffic expenses.

All of the gasoline motor omnibuses now running in London are either owned or controlled by the London General Omnibus Company and most of them were manufactured by de Dions, Straker Squires, Leylands and Daimler Motor companies.

Apparatus for Electric-Arc Welding

Theoretically any source of direct current is suitable for electric welding, but when it is considered that a potential of only from 10 volts to 60 volts is necessary at the arc it is evident that if this voltage is secured by introducing resistance in series with existing shop circuits the method will be wasteful and only a small fraction of the energy drawn from the line will actually be used in maintaining the arc. Furthermore, unless means are provided for maintaining the proper potential and for protecting the line against short circuits which necessarily occur, it would be impracticable to do electric welding from the regular shop circuits.

In order to surmount these difficulties, the C. & C. Electric & Manufacturing Company, of Garwood, N. J., has developed a special motor-generator set, together with automatic controlling apparatus, providing a ready means of efficiently transforming the energy from the shop circuit, whether alternating or direct current, to the voltage required for welding and at the same time providing against short-circuiting the machine.

The generator is of the variable-voltage type, having liberal commutator surface, and in the larger sizes is duplex wound. By employing open-type armatures large ventilating surfaces are provided and low heating limits are obtained.

The switchboard consists of a marbleized slate panel having angle iron frames on which are mounted a fused main line switch placed between the motor and the supply circuit, a no-voltage release starting rheostat for motor, and an automatic series relay in each welding circuit which operates a magnetic switch. An automatic overload relay in the motor circuit operates only on extremely heavy loads as the relays in the individual circuits take care of all ordinary rushes of current. In addition to the foregoing there are provided on the switchboard a voltmeter, an ammeter, a voltage-controlling rheostat in the generator field circuit, a set of current-regulating contacts and a small bank of resistors in the rear of the panel secured to the angle-iron frame.

When it is desired to use both the metallic electrode and the graphite electrode from the same set, a single-pole, double-throw switch is added, which permits of using either the metallic or graphite electrode alone or both at the same time. When two or more arcs are required for independent

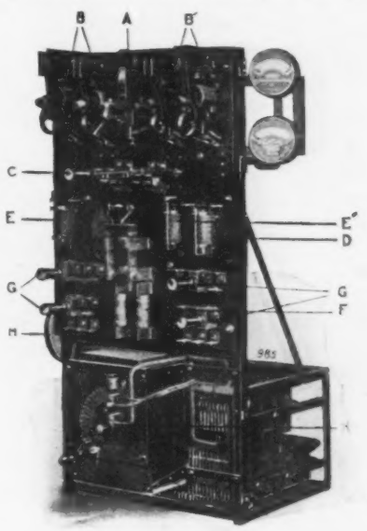


FIG. 1—QUADRUPLE CIRCUIT SWITCHBOARD

operators from the same set, the current-regulating contacts, the magnetic switch and the automatic series relay are duplicated, as shown in Fig. 1. This permits of adjusting each welding circuit independently of the other, so that the voltage and amperage can be regulated to meet exactly the requirements of the work being done by each operator.

DATA ON ELECTRIC-WELDING REPAIRS IN RAILWAY SHOPS

	Time in Minutes	Kw	Average Costs
Gear-case lugs	10	6	$0.07
Armature shaft (broken), 2-in.	60	20–30	0.80
Dowel-pin holes	5–12	4–8	0.07
Broken motor cases	150–200	75–90	4.98
Broken lugs on a compressor cover, doors and grease-cup hinges	2–5	1–3	0.03
Broken truck frames	30–60	20–35	0.63
Worn bolt holes in motors and trucks	5–10	3–5	0.05
Enlarged and elongated holes in brake levers	2–4	1½–3	0.03
Armature shafts, 2-in., worn in journals	120–180	60–90	3.75
Armature shafts, worn in keyways	10–15	7–12	0.10
Armature shaft, worn thread	20–30	10–15	0.24
Air brake armature shafts (broken)	20–30	10–20	0.27
Leaking axle boxes	5–15	3–7	0.08

It is evident that, unless some protective device is provided, the moment contact is made between the electrode and the work a short circuit will occur and the generator will be burned out or the motor circuit-breaker thrown, making it impossible to get the arc started. This contingency is provided against by means of an automatic

series relay which, when the electric welding circuit is broken, inserts resistance in series with the electrode. When it is brought into contact with the work only enough current is allowed to pass to form the arc, and when the arc is drawn this resistance is automatically cut out of the circuit and practically the full potential of the welding circuit is applied at the arc. This arrangement makes unnecessary the method that is often resorted to, namely, that of using a machine of much larger rating than is necessary to take care of the momentary overload imposed at the time of making the contact. As the machine is fully protected and operates automatically, the operator can make and break his arc as often as desired without paying any attention to the generating outfit.

To give an idea of the cost of making ordinary repairs the accompanying data, which have been compiled from the records of an electric railway repair shop, are given. A charge of 2 cents per kw-hr. is assumed for the electrical energy consumed and the labor cost is figured at 30 cents an hour. By using the figures given in the first and second

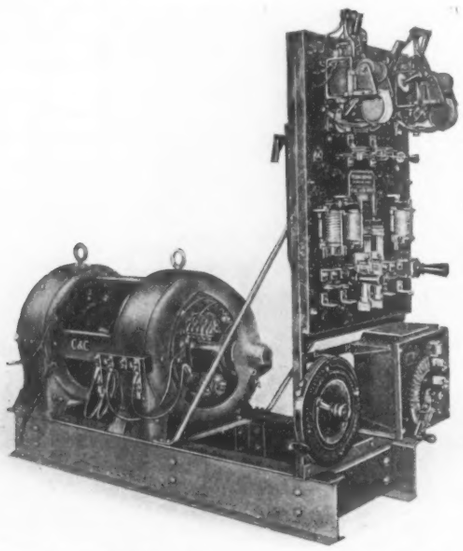


FIG. 2—MOTOR-GENERATOR AND SWITCHBOARD

columns the cost of each operation can be calculated for other shops under various conditions.

Standard equipments are built in sizes of from 150 amp to 200 amp. The average weld on heavy sections using the graphite electrode will be found to require approximately 400 amp. This includes broken truck frames and motor cases, and in general steel sections having an area of 4 in. by 5 in. Locomotive frames or pieces of similar dimensions require from 500 amp to 600 amp, while sections 6 in. in diameter and upward are best welded with from 700 amp to 800 amp at about 70 volts. In steel foundries, from 700 amp to 800 amp at from 60 volts to 75 volts will be found to be sufficient, but where there is much cutting to be done, such as removing heavy risers, etc., from 800 amp to 1000 amp at from 60 volts to 75 volts will be found to be more effective.

Moving Pictures as Targets for Marksmen

At Coney Island, the home of innovation, the latest adjunct to the shooting galleries is the addition of moving pictures as targets. A device invented by Mr. Eliot Keen has been installed to register the hits and misses of the shooters. This apparatus consists of a steel screen behind which a number of steel balls are hung by small pieces of chain at intervals of about 3 in. A bullet striking the screen imparts an impulse to the suspended balls causing them to swing outward from the screen. As the balls move away from the screen, the chains short-circuit a pair of conducting rods which are placed behind them and in this manner complete an electrical circuit and light a lamp in front of the marksman. Contactors and relays actuated by perforations in the film are arranged so that only the portion of the screen carrying the moving figure in the picture is sensitive to the bullets of the shooters. Thus if the marksman misses the moving picture no lamp is lighted, the absence of the flash signifying that the bullet has gone astray.

Turbo Air Pump

The entire absence of the external ejector nozzle marks the design of the turbo air pump shown herewith as being

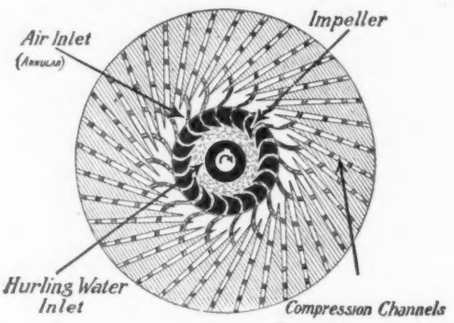


FIG. 1—SECTIONAL VIEW SHOWING PRINCIPLE OF AIR REMOVAL

distinctive from other centrifugal pumps. The pump consists of a small high-speed impeller with a large number of ports or nozzles on its periphery, a ring of tapered compression channels and a discharge casing or volute. Water enters the eye of the impeller as in an ordinary side-suction centrifugal pump and is impelled at high velocity through the ports in the impeller, which rotates in the opposite direction to the impeller of a centrifugal pump. Air is admitted around the entire periphery of the impeller and is drawn into the entrance of the tapered compressor channels by the aspirating effect of the rapidly discharged water. As the slugs of water move outward they become elongated owing to the tapering of the channels, the space between slugs decreases and the air entrapped is compressed. The mixture of air and water is delivered from the tapered channels into a volute casing, somewhat similar to that of

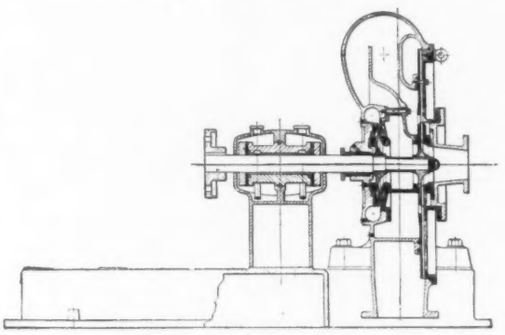


FIG. 2—CROSS-SECTION OF TURBO AIR PUMP

a centrifugal pump, and is finally passed out through a suitable outlet nozzle.

These pumps are used for both jet and surface condensers. For the latter service the turbo air pump is frequently combined in a common casing with the condensate pump, thus securing many obvious advantages. The photograph, Fig. 2, and the drawing, Fig. 3, illustrate a combined pump of this type. A distinct saving results from the fact that the amount of piping between condenser and pump is reduced and simplified, the space ordinarily required by the

two pumps for air and condensate is less, and both pumps are driven on a single shaft.

It is stated that pumps of this type will maintain a vacuum within 98 per cent to 99 per cent of the theoretical value; that is, within a very small fraction of an inch of mercury column of the vacuum corresponding to the temperature of the hurling water. This is not only true for low temperatures of water from 32 deg. Fahr. to 60 deg. Fahr. but also for hurling water at temperatures of 70 deg., 80 deg., 90 deg. Fahr. and higher, such as are encountered during the summer months and in cooling-tower work.

This pump is based on the designs of the German pump built by the Allgemeine Elektricitäts Gesellschaft and is manufactured by the Wheeler Condenser & Engineering Company of Carteret, N. J.

Electric Apparatus Uninjured by Submersion During Flood

Recent flood conditions have brought to light some interesting information regarding the dependability of electrical apparatus despite immersion. The Gray Coal Company, Danville, Ill., has two 35-hp and two 25-hp motors, one of which was completely submerged in March, 1912, owing to an ice jam which backed up the river water. The motor remained immersed ninety-two days, after which it was protected from the weather and left on the bank of the river till the early fall, when, a motor being needed, this one was tested out to determine its condition. The test showed it to be all right, much to the surprise and gratification of its owners, and so it was immediately put into service again, operating until March 24, 1913, when it was again submerged during the recent flood and remained under water until April 7, again being tested out "O.K." The other 35-hp motor was submerged last January and remained under water for ten days. It was then dried out and connected up and found to be in perfect condition. One of the 25-hp motors was also submerged but when the waters had receded it, too, was all right.

Some time ago a standard motor performed remarkable service when submerged. A 20-hp, three-phase, 220-volt induction motor geared to a mine pump at the bottom of a shaft in the mines of the Richmond Iron Works, Richmond Furnace, Mass., was submerged by surface water that flooded the shaft during a thaw. Although 2 ft. below the surface of the water, the motor continued to operate perfectly and at the end of two hours had pumped itself clear of water. It was then shut down just long enough to clean the dirt and chips from the rotor and to put oil in the bearings, after which it was restored to regular service again, pumping twenty hours a day. Its performance since shows that it was uninjured by its remarkable experience.

Motors in the Comstock mines were recently submerged with water having a temperature of 165 deg. Fahr. for twenty-four hours. After operating for a few hours with the impressed voltage reduced to dry them out, the normal load was thrown on. The motors were not damaged, although a telephone receiver was melted out of shape.

In the works of the Sweet & Doyle Foundry & Machine Company and the Twinvolute Pump & Manufacturing Company, of Green Island, N. Y., three motors and a switchboard were completely submerged during the flood the latter part of March. When the waters had subsided the dirt was washed off and the motor bearings cleaned and oiled. After an hour's run without load to dry them out, the motors were put into service and apparently had suffered no injury.

The apparatus which passed unscathed through the unusually severe tests mentioned above was manufactured by the General Electric Company, Schenectady, N. Y.

The remarkable performance of two Crocker-Wheeler motors was recently brought to light by a representative of that company while on a business trip through California.

A ranchman, Mr. W. E. Green, of Tulare, Cal., has an induction motor which drives a pump for irrigation purposes. One night the service failed and the no-voltage release disconnected the motor, thereby stopping the action of the pump. During the night the water backed up from the irrigation ditch into the pit and submerged the set under 4 ft. of water.

In the morning the ranchman, who had not noticed that the motor was flooded, started the set which ran from 10 to 15 minutes under water. When he discovered to his surprise that the motor was submerged the machine was taken out, dried in an oven and immediately put into service again. It has been continuously running without repair or extra attention ever since.

A somewhat similar occurrence was reported by Messrs. Sturgeon & Saults. In this case the water backed up from the ditch into the pit while the set was running and submerged both the pump and the motor. The set, however, continued to run until the pump became so clogged with dirt that the fuses blew out. The farmer having cleaned the pump and pit started the set again without further precautions and this set also has been running satisfactorily ever since.

While the Crocker-Wheeler Company has made in certain instances specially insulated waterproof apparatus, the two motors mentioned above were standard stock machines for which no claim was made that they would operate under water.

Floating Transformer Station and Pumping Outfit

In order to irrigate its rice fields along the Sacramento River, the Moulton Irrigated Land Company, Butte County, Cal., has adopted the somewhat unique plan of installing a motor-driven pump on a barge, which is towed from point

FLOATING PUMPING OUTFIT ON SACRAMENTO RIVER

to point by a gasoline launch and is thus able to accomplish what would otherwise require four stationary plants.

The barge contains a 20-in. Dow centrifugal pump belted to a 100-hp Westinghouse induction motor. Electrical energy is obtained at the four pumping points from the 11,000-volt lines of the Pacific Gas & Electric Company. A bank of transformers on the barge transform the energy to 440 volts for use by the motor.

The pump is capable of delivering about 16,000 gal. of water per minute. The head varies from 12 ft. to 23 ft. as the river rises and falls, and the motor is overloaded about 30 per cent when the river is at its lowest point, but it has carried this overload for considerable periods of time without distress.

The pump is operated almost continuously from April to August, being shut down only when the barge is being towed from one point to the next.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Copper-Covered Wire.—The increasing demand for copper-covered wire is strikingly shown by an order recently received by the Standard Underground Cable Company for ten carloads of "Colonial copper-clad" wire from a customer who has been using this kind of wire for years.

Finds a Demand for Metallic Brushes.—The Nungesser Carbon & Battery Company, of Cleveland, Ohio, which makes a specialty of furnishing metal brushes for automobile electric starters, reports that it is enjoying an excellent business among the manufacturers of that class of apparatus.

May Sales Record-Breaking.—Gross sales for the month of May, 1913, by the Western Electric Company reached a total of $7,800,000, which is $800,000 greater than the total for the best previous month's sales in the company's experience, namely October, 1912. Although the latter year was the most active in the history of the company, the sales this year have been showing steady gains over those for corresponding periods in 1912.

Ohio Manufacturer Busy.—Recent sales made by the Foos Gas Engine Company of Springfield, Ohio, include oil and producer gas engines for use in waterworks and refrigerating plants and for driving generators. Among the purchasers are the city of Saline, Mich., United States Government, Fredericksen Ice Company of Chicago, Ill., William Gordon, Atlantic City, N. J., and the Deposit Milling Company of Deposit, N. Y. The combined horsepower represented in these sales is 550.

New Welding Machine to Be Marketed.—The Lincoln Electric Company, of Cleveland, Ohio, has completed the development of a machine which will take alternating current and deliver direct current with a drooping characteristic, adaptable to welding work without the necessity for using resistance in series with the arc. It is expected that this machine will have even a larger field than the welder, operating on direct current, which this company has sold for several years.

Terry Turbines and Pumps Sold.—A good sized order was recently placed with the Terry Steam Turbine Company, of Hartford, Conn., by the Milwaukee Electric Railway & Light Company, of Milwaukee, Wis., including two 60-hp turbines for driving circulating pumps, and two boiler feed pumps, rated at 20 gols. per minuts. There was also purchased in the same order, three stoker blower sets for the Racine plant of the latter company, and two sets of pumps for their generating station at Kenosha.

Taylor Stoker Sales.—Sixteen large companies have recently placed orders with the American Engineering Company, of Philadelphia, Pa., for its Taylor stokers. The Rochester Railway & Light Company, of Rochester, N. Y.; Lake Shore & Michigan Southern Railway Company, Air Line Junction, Ohio; Fitchburg (Mass.) Gas & Electric Company and the Narragansett Electric Light Company, Providence, R. I., were among the larger utilities buying this apparatus.

The Moloney Electric Company of St. Louis has established offices at Toronto, Ont., Winnipeg, Manitoba and at Vancouver, B. C. Its office at Toronto is located in the Canadian Pacific Railroad Building and is under the supervision of Mr. George C. Leacock, who was formerly with the Packard Electric Company. Mr. Leacock is district business manager of the entire part of Ontario. The district office which was opened at Winnepeg is located in the Electric Railway Chambers Building and is in charge of Mr. C. H. Abbott, who was also formerly with the Packard Company. Mr. Abbott will have charge of all business in Manitoba, Saskatchewan, Eastern British Columbia and Alberta. Mr. Seth B. Smith, formerly business manager of the Westinghouse office at Vancouver, is now district manager of the Moloney Electric Company's office in that city. This office is located in the Vancouver Block. Mr. Smith has been with the latter company several months.

In addition to the factory which the Moloney Electric Company has in St. Louis, it also operates a factory at Windsor, Ont., employing about 45 men. Mr. W. R. Ker is in charge of the offices at that place.

Forthcoming Convention of Federal Sign System (Electric).—The annual convention of branch-office managers and department heads of the Federal Sign System (Electric) will be held in the Moraine Hotel, Highland Park, Ill., on July 30 and 31 and Aug. 1. It is expected that between seventy-five and eighty men will be in attendance. One day will be devoted to an exposition of the products of the Sangamo Electric Company, Pittsburgh Transformer Company and other manufacturers for which the Federal Sign System acts as distributor.

Alberger Sales Steady.—The Alberger Pump & Condenser Company, of 90 West Street, New York, is doing a good business in spite of the dull season. Among the recent shipments of special note have been to the Monarch Cotton Mills, at Union, S. C., Boston & Maine Railroad, Pennsylvania Coal Company, for its Underwood Colliery, at Dunmore, Pa., and to the San Joachim Light & Power Company, Bakersfield, Cal. The first two concerns each bought a 32-in. "Spiroflo" condenser with centrifugal removal and vacuum pumps, while the latter company obtained a 15,000 sq. ft. surface condenser.

Western Hydroelectric Apathy.—A prominent New York man, who is in close touch with hydroelectric development work throughout the country, has recently returned from a trip to the Pacific Coast, and in an interview with a representative of the *Electrical World*, he stated that, due to the difficulty of financing at this time, there are practically no new hydroelectric plants now projected in the West. Work is progressing on installations now partially completed, but nothing new is planned. He stated further, that the same condition in general exists in the South, to the best of his knowledge, and that he did not expect any real activity in this line until after the first of the year.

Electrically Operated Grain Elevator at Kansas City, Kan.—The new electrically operated 1,000,000-bushel concrete grain elevator which was built for the Chicago, Rock Island & Pacific Railway Company at Kansas City, Kan., by the Macdonald Engineering Company of Chicago was completed and received its first supply of grain by means of its new electrical equipment on July 1. The erection and electrical wiring of this elevator, as well as the conversion of the old 1,000,000-bushel steel elevator, which adjoins it, from a rope-transmission to an electrically operated elevator, was commenced on Jan. 15, 1913, so that the time of erection is considered somewhat of a record. The electrical wiring was done by the Freeman-Sweet Company, Chicago, and the placing of conduits, which had to be laid in the forms before the concrete was poured, was in charge of Mr. J. C. McGivney, superintendent on the job. Motors ranging in size from 5 hp to 75 hp were installed in the two elevators with an aggregate rating of 1040 hp. Although energy for the operation of the motors will under ordinary conditions be supplied by a 450-kva, three-phase, 480-volt, 60-cycle General Electric generator on the grounds, auxiliary service for use in case of emergency will be available from the municipal electric plant of Kansas City, Kan.

Crocker-Wheeler Apparatus Used.—Under the heading "Electrical Energy for Large Chicago Tannery" mention was made in the July 19 issue of the *Electrical World* of the power equipment for the Griess-Pfleger Tanning Company. Word comes from the Crocker-Wheeler Company, of Ampere, N. J., correcting the statement of the make of electrical apparatus installed. According to these advices the equipment consisted of two 715-kva, 440-volt, three-phase, 60-cycle engine type Crocker-Wheeler generators. running at 120 r.p.m. and directly connected to Corliss engines of Nordberg Manufacturing Company's make, and one 214-kva alternator of the same type, running at 150 r.p.m. and directly connected to one of the Bail Engine Company's four-valve engines. All three units have belt-driven exciters.

Boston & Maine Power Plant Equipment.—An extension installation of electrical and power apparatus is being made by the Boston & Maine Railroad at its Billerica shop power house. Five 500-hp Babcock & Wilcox boilers with Murphy Iron Works stokers are being put in, together with a considerable amount of auxiliary pump condenser and air compressor equipment. The electrical machinery to be installed consists of two Rice & Sargent engines, each connected directly to a 350-kw, 600-volt, 25-cycle, 3-phase generator; one 750-kw generator of the same type driven by a mixed pressure turbine, and one 50-kw generator, also of the same type, coupled to a marine type engine; two 50-kw, 125-volt exciter sets, connected to marine type engines, and one motor-generator set, comprising a 200-kva, 25-cycle motor, directly connected to a 125-kw, 250-volt, direct-current generator. All of the electrical apparatus is of General Electric make. On the section between Hinsdale, N. H., and Brattleboro, Vt., just recently put in operation by the Boston & Maine twenty-five automatic and five semi-automatic electric block signals are in use, supplied by the Union Switch & Signal Company, of Swissvale, Pa. Okonite wire used for the underground circuits on this signal system was supplied by the Pettingell-Andrews Company, of Boston, Mass.

Additional Electrical Equipment for the Western Electric Company.—Three five-story structures have been added to the existing factory of the Western Electric Company at Hawthorne, Ill., the motor and electric light wiring for which is being done by the Freeman-Sweet Company of Chicago. About 2600 incandescent lamps will be installed, which will be of 25-watt, 50-watt and 100-watt tungsten types. Service wires will also be run for supplying motors with energy, but no definite number of units has been decided upon at the present writing. Outlets have been provided from which wires can be run to the motors as they are installed. Six feeders will be run from the isolated generating station which this company operates, through a tunnel in lead-sheathed cables, to the buildings in which the service is required. Each of the feeder cables contains three conductors having 250,000 circ. mils cross-section. Service for both the lamps and motors will be supplied at 440 volts, 60 cycles, three-phase, through exposed conduits. The lighting panel boards are peculiar in construction as the lamps will be fed from the 440-volt feeders and from a grounded neutral. Each lamp outlet is supplied with a phase wire and a grounded neutral.

Electrical Equipment of a Modern Loft Building.—By courtesy of C. A. Williams, of the Van Wagoner-Linn Construction Company, contracting electrical engineers, of 1133 Broadway, New York, details on the electrical equipment of the new Mercantile Building, 424-438 West Thirty-third Street, New York, have been received. The building is twelve stories high and is equipped with two high-speed Otis passenger elevators and three three-ton freight elevators. The main switchboard of marbleized slate was supplied by the Metropolitan Electric & Manufacturing Company, of Long Island City, N. Y., and contains separate feeder switches for each riser, also a breakdown panel providing for the future installation of an isolated generating plant if desired. At present Edison current is used. There are fifty six-light outlets on each floor for illumination. Provision has been made for supplying 100 hp for drive purposes on each floor and the installation of empty conduits will take care of future needs in this line. There are two marbleized slate panel boards measuring 6 x 4 ft. on each floor, divided into two sections, one for the lighting and the other for the power circuits. The lighting section of each board has fourteen circuits of 25 amp capacity each, and the power section has sixteen circuits of 50 amp each. These boards were also supplied by the Metropolitan Company. The conduits used were made by the Central Tube Company, of Pittsburgh, Pa., and there are installed on the power circuits now in use twelve 50-amp solenoid switches, furnished by the Hart Manufacturing Company, of Hartford, Conn. There were also installed a number of Cutler-Hammer starters of the latest type, operated by remote contact switches. The entire equipment was put in by the Van Wagoner-Linn Construction Company, of New York.

Electric Trucks Popular.—Among recent sales of the General Vehicle Company's electric trucks the following are of special note: American Express Company, twenty-five two-ton cars; New York Railways Company, twenty-nine; New York Edison Company, five five-ton trucks; Lord & Taylor, six 1000-lb. wagons; General Baking Company, four 1000-lb. cars; American Agricultural Chemical Company; three 2000-lb. trucks; and Franklin Simon & Company, three 1000-lb. cars. The great bulk of trucking and delivery work lies in the field of short haul service and for such work the electric truck and delivery wagon are pre-eminently fitted. But there is occasionally a demand for a truck for long haul service and in the process of this company's growth it has been found that calls for cars to handle such service are sufficiently frequent to make it advisable to develop a car especially for that service. About a year ago a thorough study of this question led to the determination that a gasoline car would be best fitted to meet this special demand and, after considerable investigation into the merits of various makes, the American rights of the German Mercedes car were secured and plans laid for the manufacture of these cars in this country. At the present time there is building at the Long Island City plant of the company a one-story brick factory, measuring 50x240 ft., which will be devoted to the manufacture of the above type of gasoline trucks, ranging in capacity from four to ten tons. A reflection of the growth of the company's business in the electric truck line can be seen in the fact that there is also under construction, at the same location, a six-story factory, measuring 75 x 500 ft., the lower five stories of which will be equipped for the manufacture of electric commercial cars, the top floor being intended for the company's main offices. Two passenger and two freight elevators will be installed in this building, which is of fireproof, structural steel and reinforced concrete design, and the cost of the building alone without manufacturing equipment is estimated at close to $500,000. An isolated generating plant installation will supply light and power for the entire group of buildings when completed. It is expected that the construction work will be finished and cars turned out from both of these factories about Jan. 15, 1914.

NEW YORK METAL MARKET PRICES

	July 15		July 22	
	Bid.	Asked.	Bid.	Asked.
Copper:				
Standard, spot*	13.25	.....	14.00	.....
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	62 8 9		64 8 9	
Prime Lake	14.50	.....	14.50	to 14.60
Electrolytic	14.15	to 14.25	.....	14.50
Casting	14.05	to 14.15	14.25	to 14.35
Copper wire base	15.50	.....	.....	15.50
Lead		4.35		4.35
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f. o. b. smelter		7.00		7.00
Spelter, spot	5.30	to 5.35	.....	5.40
Tin, spot*	39.70	to 40.00	41.00	to 41.50
Aluminum:				
Prompt delivery	23.00	to 23.50	23.00	to 23.50
Future	21.00	to 22.00	21.00	to 22.00

*OLD METALS

Heavy copper and wire	13.25	13.25
Brass, heavy	8.12½	8.25
Brass, light	7.25	7.25
Lead, heavy	4.25	4.25
Zinc, scrap	4.37½	4.25

*COPPER EXPORTS

Total tons to July 22 18,033

*From daily transactions on the New York Metal Exchange.

Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	July 16	July 23
Allis-Chalmers, t.r., 5th pd	$19,800,000	.....	.....	5⅞	7⅛*
Allis-Chal., pf.,t.r.,5th pd.	16,050,000	.....	.....	14⅞	15
Amalgamated Copper	153,887,900	1½	Q	66½	69¼
American Tel. & Tel.	344,471,400	2	Q	127⅞	128
Electric Storage Battery,c.	16,074,425	1	Q	46½	47⅜
General Electric	101,363,600	2	Q	139½	139⅜
Mackay Cos., c.	41,380,400	1½	Q	77½	77½*
Mackay Cos., pf.	50,000,000	1	Q	68	68*
Western Union Tel.	99,747,600	¾	Q	61½	63*
Westinghouse, E. & M., c.	34,496,400	1	Q	59	61½
Westinghouse, E. & M., pf.	3,998,700	1¼	Q	109	110*

*Last price quoted.

Business Notes

The Blake Signal & Manufacturing Company has moved its Boston office from 246 Summer Street, to 251 Causeway Street.

General Electric Company.—Mr. S. H. Boyer, formerly assistant district manager in the Chicago office of the General Electric Company, has been made district manager for the company at St. Louis, Mo.

R. H. Henderson, for a number of years works manager of the Westinghouse Lamp Company, has resigned and will be succeeded by H. S. Black, formerly manager of the St. Louis Magda Lamp Works of the General Electric Company.

The Electric Construction Company has been organized at Gadsden, Ala., and has opened a store at 111 North Fourth Street. A line of electrical supplies will be carried and general electrical work engaged in. Mr. B. W. Erwin and Mr. Holly Midgeley are the organizers of the new company.

Mr. C. M. Welch, formerly manager of the transformer department of the Duncan Electric Manufacturing Company, Lafayette, Ind., has been recently chosen for a position in the main office of Moloney Electric Company, St. Louis, Mo. His brother, Mr. Jas. E. Welch, who was associated with him, is superintendent of the St. Louis factory.

C. V. Kerr, formerly chief engineer for McEwen Brothers, Wellsville, N. Y., has severed his connection with that company after three and a half years' work in developing a helical pump and a propeller blower and is now engaged in the private development of a group of turbine-driven power-plant auxiliaries. His business address is Wellsville, N. Y.

Gagen & Butler, Inc., have opened offices as electrical engineers and contractors at 1402 Broadway, New York. James M. Gagen is president and Edwin C. Butler secretary and treasurer of the firm, which will continue the business carried on by Mr. Gagen for the past two years. Mr. Butler was associated for several years with Harry Alexander and other electrical concerns.

National Carbon Company's Jovian Ritual Team.—The rejuvenation of the Jovian Order held at Cedar Point, Ohio, July 18, during the nineteenth annual convention of the Ohio Electric Light Association, was in charge of an organized ritual team composed of representatives of the National Carbon Company of Cleveland. The team, which consists of seventeen members, possesses a complete outfit of costumes and paraphernalia, and is in a position on twenty hours' notice to conduct a ritual anywhere within a night's ride of Cleveland without expense to the local chapter. The National Carbon Company has organized its own Jovian chapter with a membership of seventy, the first in the order to be formed entirely within a commercial organization. The newly elected officers of this chapter are: President, Mr. N. C. Cotabish; vice-president, Mr. M. W. Allen; secretary, Mr. E. M. Spellman; treasurer, Mr. T. J. Wearty; sergeant-at-arms, Mr. A. T. Baldwin; press agent, Mr. E. H. Martindale. Nine candidates were initiated at Cedar Point, the rejuvenation being in charge of Statesman M. H. Moffet of Cleveland.

New Industrial Companies

The Graves Engineering Company, of New York, N. Y., has been incorporated by C. A. Graves, of Brooklyn; C. N. Jones and F. B. Erwin, of New York. The company is capitalized at $100,000 and proposes to do a mechanical and civil engineering and contracting business.

The Right-Light Company, of Marion, W. Va., has been incorporated with a capital stock of $10,000 by A. F. Millan, T. V. Morgan, E. D. Conway, H. R. Williams, W. C. Byrd and G. B. McNeely, all of Mannington, W. Va. The company proposes to manufacture light and heat appliances.

The Mutual Railways Utilities Corporations, of New York, N. Y., has been incorporated by William Chapman, 20 Benet Street, Arlington, N. J.; Walter Neville, 31 Nassau Street, and C. William Stengel, 146 Liberty Street, both of New York. The company is capitalized at $1,000,000 and proposes to do a manufacturing and construction business.

Trade Publications

Pumps.—In Bulletin No. 115 double-acting plunger pumps of the horizontal type, made by the Goulds Manufacturing Co., Seneca Falls, N. Y., are illustrated, and complete specifications are given.

Watt-Meter Boxes.—The Appleton Electric Company, Chicago, Ill., has issued a complete booklet listing and describing its complete line of watt-meter boxes which have been approved by the National Board of Fire Underwriters and are used by the city of Chicago in all apartment, store and office buildings. The boxes are made in three sizes, 1-30 amp, 31-60 amp and 61-100 amp.

Measuring Instruments.—The American Every Ready Company, 304 Hudson Street, New York, has assembled within a recently published 32-page catalog information concerning "Eveready" direct-current measuring instruments. Various types of switchboard instruments, automobile types, portable types, portable shunts and switchboard and semi-portable external shunts are illustrated, and a page is devoted to a diagram of connections.

Reflectors.—A number of pleasing designs of Brascolite Luminous Units are shown in a recent publication of the Luminous Unit Company, Jefferson and Washington Avenues, St. Louis, Mo. These units are self-contained, and do not depend upon the ceiling in any way for reflection of light. Some efficiency test data are given. The catalog shows a wide range of designs. It is printed on paper free from glare and has an effective cover.

Paint.—Rice's "Mill White," a special paint made for the interior of industrial plants, is the subject of some recent advertising literature issued by the United States Gutta Percha Paint Co., Providence, R. I. The advantages of this paint are convincingly set forth in a pamphlet entitled "More Light" and in another entitled "Make the Most of Daylight in Your Plant." Both of these contain illustrations of industrial plants in which this paint was used.

Storage Batteries.—The Edison Storage Battery Company, 1022 Lakeside Avenue, Orange, N. J., has issued an illustrated booklet with the front-cover title of "N. E. L. A. Chicago Convention, June 2-6, 1913. In Memoriam," which contains, as stated on the first page, "convention conversations that did not get into the 'Proceedings,' and some of the features of the convention and stories that were told but not recorded referring particularly to the Edison storage battery." Some interesting pictures and catchy paragraphs make a readable booklet.

Electrical Trucks.—"G. V. Electrics for Grocers" is the title of a booklet issued by the General Vehicle Company, Long Island City, N. Y. It tells the story of the successful use of its electric trucks by wholesale and retail grocers, pictures and data adding interest and usefulness to the little publication. The actual experiences of grocers in the use of trucks are set forth, and a table showing approximate cost of operation is included. The subject of trucks in department stores is similarly treated in a separate pamphlet.

GRIPPER AND SIDE GUIDE.

Personal Mention

Mr. S. T. Stewart, manager of the Muskegon office of the Grand Rapids-Muskegon Power Company, has resigned.

Mr. T. N. Young has succeeded Mr. L. B. Carl as superintendent of the municipal water, electric lighting and power plant of Marshfield, Wis.

Mr. Samuel T. Beatty, formerly at Hackettstown, N. J., is now associated, as superintendent, with the Danville (N. Y.) Gas & Electric Company.

Mr. Kempster B. Miller, consulting engineer, has returned to his home in Chicago after a short vacation sojourn in Great Britain and on the Continent.

Mr. M. L. Sperry, manager of the Savannah (Ga.) Electric Company, has been transferred to the New London (Conn.) Gas & Electric Company, controlled by the same interests.

Mr. H. L. Williams, who has been associated with the Rawlins (Wyo.) Electric Light & Fuel Company, has become manager of the Evanston (Wyo.) Electric Light Company.

Mr. F. A. Sherwood, formerly of the Richfield (Utah) Electric Light & Power Company, has been appointed local manager of the Caldwell (Idaho) plant of the Beaver River Power Company.

Mr. John O'Connell, manager of the South Deerfield office of the Greenfield (Mass.) Electric Light & Power Company, has resigned. His successor is Mr. R. Leavitt of Shelburne Falls.

Mr. Louis Streng, formerly chief engineer of the Kentucky Electric Company, Louisville, has been retained as consulting engineer by the Louisville Gas & Electric Company, its successor.

Mr. G. O. Miller, who has been local manager of the Muncie Electric Light Company at Eaton, Ind., has been transferred to Hartford City, Ind. His successor at Eaton is Mr. Wilber Lyons.

Mr. F. Rainbow, formerly with the Neligh Mills lighting plant, at Neligh, Neb., has assumed the management of the Pierce (Neb.) Milling Company, which operates an electric light plant in connection with its mill.

Mr. H. E. Smoot, formerly general manager of the Idaho-Utah Electric Company, has become associated with the Richfield (Utah) Electric Light & Power Company as manager, succeeding Mr. F. A. Sherwood.

Mr. Theodore T. Haldeman, for the last 18 months superintendent of the Washington Electric Company of Washington, N. J., has been appointed superintendent of the municipal electric-light plant at Dover, Del.

Mr. Joseph A. Brennan, formerly with the electrical construction department for the new Subway, New York City, has been appointed to a position with the electrical staff in charge of the Panama Canal work on the Isthmus.

Mr. C. W. Kellogg, Jr., has been appointed manager of the Beaumont (Tex.) Electric Light & Power Company. Mr. Kellogg was formerly local manager for the Stone & Webster Company in charge of the El Paso Gas & Electric Company.

Mr. Charles W. Wilcox, for the last three years manager of the Shelburne Falls (Mass.) office of the Greenfield Light & Power Company, has resigned his position. Mr. Wilcox has been connected with the electric-lighting industry for 18 years.

Mr. H. E. Brandli has been made manager of the properties of the Citizens' Gas, Electric & Heating Company at Mt. Vernon, Ill., succeeding Mr. C. B. Severson, transferred to New York, as purchasing agent for the Doherty Operating Company.

Mr. Jefferson Alexander, superintendent of the Houghton (Mich.) County Electric Light Company, has been appointed general superintendent of the Savannah (Ga.) Electric Company as successor to Mr. H. C. Foss, who has been made acting general manager.

Mr. W. T. Maddox, assistant general manager of the Utah Light & Railway Company, Salt Lake City, Utah, has resigned from the company and has retired from active work. Mr. Maddox left for Southern California, where he will live on his ranch near Gardena.

Mr. Thomas W. Haldeman, who has been general manager of the Point Pleasant (N. J.) Electric Light & Power Company, has returned to Washington, N. J., to resume charge of the Washington Electric Company, a position which he relinguished in February, 1912.

Mr. T. W. Norcross, formerly district engineer at Denver, Col., for the United States Forest Service and engaged in power and irrigation work in eight of the western states, has been promoted to the position of assistant chief engineer, with headquarters at Washington, D. C.

Mr. J. Hoadley Cochran, who has for several years been in charge of the plant of the George Fetter Company of Louisville, recently acquired by the Louisville Gas & Electric Company, continues the management of that plant, which manufactures considerable quantities of ice.

Mr. W. E. Shaw has been appointed local manager of the York Light & Heat Company, Biddeford, Me., as successor to Mr. J. G. Shaw, former vice-president and manager, who resigned when the company was taken over by the Cumberland County Power & Light Company, Portland, Me.

Mr. L. A. Bailey, at present electrical inspector of the Oklahoma Fire Inspection Bureau, will leave Aug. 7 to become engineer for the Rock Mountain Fire Underwriters Association, Denver, Col., succeeding Mr. W. J. Canada, who has resigned to take up special investigation work for the Bureau of Standards.

Obituary

Anthony Nicholas Brady, the well-known public utility magnate of New York and Albany, died in London, England, on July 22, from angina pectoris. At the time of his death Mr. Brady was close on to seventy years of age, having been born on Aug. 22, 1843, at Lille, France, of Irish parents. He came to the United States with his parents and settled in Albany, N. Y., where young Brady attended school until he was thirteen years old. He then went to work and for a time was employed at the Delevan House, an Albany hotel, where he remained until he became of age. His subsequent career is merely indicative of the fact that the country possesses untold wealth for those who care to wrestle with it. His financial career was at its zenith when the end came. His personal influence, however, went beyond the sixty large corporations in which he was a director and his interests included those of transportation, electricity, gas, rubber, oil, paving materials and tobacco. He was a power in the American Tobacco Company and also made much money in the oil industry. Mr. Brady was best known, however, as a promoter of public service corporations. He first purchased the gas plants at Albany and Troy, N. Y., and in Chicago, and then began to buy up trolley lines, first in Albany and then in other cities, and also electric light plants. A list of the purely electric public utility companies in which he was interested follows: Astoria Light, Heat & Power Company, Long Island City, N. Y.; Consolidated Gas Company of New Jersey, Long Branch, N. J.; Consolidated Light & Power Company, Whitehall, N. Y.; Edison Electric Illuminating Company of Brooklyn, Kings County Electric & Power Company of Brooklyn, New York Edison Company, United Electric Light & Power Company, New York; Consolidated Gas, Electric Light & Power Company, Baltimore; Glens Falls Gas & Electric Company, Louisville Lighting Company, Memphis Consolidated Gas & Electric Company, Northern Westchester Lighting Company, Peekskill Lighting & Railroad Company, Utica Gas & Electric Company, Westchester Lighting Company, Yonkers Electric Light & Power Company, Municipal Gas Company of Albany, United Gas, Electric Light & Fuel Company, Fort Edward, N. Y.; Troy Gas Company, Dayton Light, Heat & Power Company and the Chattanooga & Tennessee River Power Company. He was also a member of the board of directors of the Westinghouse Electric & Manufacturing Company. He is survived by his widow, his son, Nicholas F., who succeeded him recently as president of the New York Edison Company, another son, J. C. Brady, and three married daughters.

GRIPPER AND SIDE GUIDE

Construction

New England

KEENE, N. H.—Bids will be received by the trustees of State Normal School at Keene, N. H., until Aug. 5 at the office of the superintendent of public instruction, State House, Concord, N. H., for the erection and equipment of school building, dormitory and boiler house, including plumbing, heating, electric wiring, chimney and boilers. Plans and specifications may be obtained upon application to Brainered & Leeds, architects, 89 Franklin Street, Boston, Mass. A deposit of $10 will be required for each set of plans, to be refunded upon return of same.

NEW BOSTON, N. H.—The Manchester Trac., Lt. & Pwr. Co. has petitioned the Public Service Commission for permission to purchase the electric-light plant in New Boston, owned by Allen P. Wilson.

SUNAPEE, N. H.—The Public Service Commission has granted the Sunapee El. Lt. & Pwr. Co. permission to issue $10,000 in capital stock.

CHESTER, VT.—The Chester Wtr. & Lt. Co. expects to purchase within the next six months 60-cp incandescent tungsten street lamps, 3.5-amp with large series base. The company would like to receive prices on street lamp posts.

MONTPELIER, VT.—The Consolidated Ltg. Co., of Montpelier, is erecting 22 miles of 33,000-volt, three-phase transmission line on wishbone cross arms; also a brick substation on Granitville, 30 ft. by 40 ft., to have an ultimate capacity of 2700 kw. H. D. Larrabee is manager.

PROCTOR, VT.—The Vermont Marble Co., of Proctor, expect to have erected within the next six months a hydroelectric plant at Beldens, Vt., consisting of two 1200-hp units to furnish power for its 45,000-volt system. The company is also extending its distributing circuits to outlying quarries and plants, and installing about 300 hp in motors this summer. C. T. Maynard is electrical engineer.

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 30 for installing an underground electric transmission line from the navy yard, Boston, to the naval hospital at Chelsea, a distance of about 1 mile. Plans and specifications may be obtained on application to the bureau. William M. Smith is acting chief of bureau.

BOSTON, MASS.—Bids will be received at the office of the fire commissioner, Bristol Street, Boston, Mass., until Aug. 7, for work in connection with the underground construction of the fire alarm branch of the Fire Department of the city of Boston, comprising the laying of about 5000 ft. of single-duct, 200 ft. of two-duct, 100 ft. of four-duct, the setting of 46 lamp posts and four test posts, according to plans and specifications, which may be obtained at the office of the superintendent of fire alarms, Bristol Street, Boston. Charles H. Cole is fire commissioner.

FALL RIVER, MASS.—Many improvements and extensions are being made to the plant of the Fall River El. Lt. Co. An addition will be made to the boiler house and equipment installed which will double its capacity. A 4000-kw Curtis General Electric turbine and a complete coal-handling equipment and Taylor stokers are to be installed. At the Hartwell Street substation a 16-panel switchboard with concrete-cell construction is now being added. The ornamental lighting system, the contract for which was recently signed by the Mayor (see issue of June 14) will require 96 6.6-amp magnetite inverted arc lamps and two 75-lamp 6.6-amp General Electric mercury-arc rectifiers, and will soon be in operation. Albert F. Dow, president.

FITCHBURG, MASS.—The Board of Aldermen and Council have authorized the installation of 37 twin-cluster lamps on Water Street.

LUDLOW, MASS.—Work has begun on the steam-power plant of the Ludlow Manufacturing Associates. This extension is to supply energy for the new mill which is now under construction. A General Electric 2500-kw turbine, together with boilers, stokers and other equipment, has been ordered. Sidney Stevens is agent.

SOUTHBRIDGE, MASS.—Arrangements are being made, it is reported, by the Central Mills Co. to operate its mills by electricity. Two new motors and a 200-kw generator are to be installed. Calvin D. Page is president.

SPRINGFIELD, MASS.—A permit has been granted to the Hendee Mfg. Co. for the erection of a power house, 163 ft. by 43 ft., to be located on Page Boulevard.

SPRINGFIELD, MASS.—The United El. Lt. Co., of Springfield, is now installing one 4500-kw Parsons steam turbine and four 400-hp Porcupine boilers, four Murphy furnaces, several sections of 5500-volt switching apparatus and erection of substation for 500-kw, 66,000-volt transmission system. W. L. Mulligan is manager.

STERLING, MASS.—Extensions have been made to the distributing system of the municipal electric-light plant to the farming district this year at a cost of $10,000. Further extensions may be made in the fall or next spring as the town may vote. Energy for operating the municipal plant is purchased from the Connecticut River Transmission Co., of Fitchburg, Mass. H. W. Rugg is superintendent.

STOCKBRIDGE, MASS.—The Stockbridge Ltg. Co. expects to erect within the next three months 2 miles of No. 2, four-wire two-phase, and approximately 3 miles of No. 6, single-phase, 2300-volt tranmsission lines. Joseph Franz is engineer.

TAUNTON, MASS.—The finance committee of the City Council has voted in favor of appropriating $50,000 for the purchase of a new turbo-generator for the municipal electric-light plant.

WARE, MASS.—The Central Mass. Elec. Co. has extended its lines through the woods to the shores of Forest Lake, a summer colony. Energy will be furnished for lighting and also for domestic purposes. At the water's edge a sign will be built giving the name of Kamp Wumfort Canoe Club, which will provide ample illumination at that point.

WRENTHAM, MASS.—Bids will be received by the trustees of the Wrentham State School, at the office of Kendall, Taylor & Co., architects, 93 Federal Street, Boston, Mass., for construction of brick custodial building, two brick dormitories, three wooden employes' buildings, and administration building, additions to the service building and addition to power house; separate contracts will be made for erection, heating, plumbing and electric work. Plans and specifications may be seen at the office of the architects, and plans will be loaned if desired at the cost of printing same. Albert L. Harwood is chairman, trustees.

PROVIDENCE, R. I.—The Rhode Island Transmission Co., which is owned by the New England Pwr. Co., is reported to have closed a contract with the Narragansett El. Lt. Co. and the city of Providence, whereby it will secure entrance on favorable terms to the manufacturing section of Rhode Island. Under the contract the New England Pwr. Co. will sell hydroelectric power to the Narragansett company, which will distribute it over the entire district.

WOONSOCKET, R. I.—The new five-year contract recently granted the Blackstone Valley Gas & El. Co. for lighting the streets becomes effective July 1 and provides for arc lamps at the rate of $85 each a year, instead of $120 as in the past five years. The incandescent lamps will be 60 cp instead of 40 cp as in the past, and will cost $27.50 each instead of $30 for the 40 cp. When the number of incandescents reaches 185 the price will be reduced automatically to $25 each. The present number is 114. A. T. Townsend, manager.

ANSONIA, CONN.—The Ansonia Brass & Copper Co. is reported to be making arrangements to operate all its local plants by electricity, to be supplied from the plant of its subsidiary, the A. B. & C. Co. Permission has been granted the Ansonia Brass & Copper Co. to lay conduits between the plants.

Middle Atlantic

BUFFALO, N. Y.—The Buffalo Package Co., 478 Babcock Street, Buffalo, will erect a power house at its plant at Babcock Street and Erie Railroad.

CHATHAM, N. Y.—The Village Trustees are considering the question of establishing a municipal electric-light plant.

CLAYVILLE, N. Y.—Arrangements are now being made by the Board of Village Trustees with the Utica Gas & El. Co., of Utica, for lighting the streets of Clayville with electricity.

CORNING, N. Y.—The Corning Gas & El. Co. is reported to have abandoned its plan to erect an electric plant in Corning and will contract with the Elmira Lt., Wtr. & Ry. Co. for the energy to operate its system. Energy will be delivered to the city line at 22,000 volts.

JAMESTOWN, N. Y.—The Board of Electric Lighting Commissioners expects to purchase within the next few months one 1000-kw, 60-cycle, 2300-volt turbo-generator, three stokers and switchboard panel for above generator; also two 75-lamp rectifier sets, and 150 series arc lamps. It is also proposed to repair the testing shops and store house. All improvements are subject to outcome of election on a proposition to issue $40,000 in bonds. C. O. Johnston is superintendent.

KINGSTON, N. Y.—The Kingston Gas & El. Co. has, since January, erected 77,600 ft. in extensions to its transmission line, providing for the installation of 450 hp in motors besides building 41,978 ft. of distribution line to Lake Katrine. Two 200-kva transformers, five 13,200-volt, three-pole Burke high-voltage air-break switches, five 13,200-volt, three-phase combined horn-type lightning arresters, three steel substation towers, one 500-kva transformer, 330 direct-current luminous inclosed arc lamps, nine 50-lamp combined rectifier sets, 7 lightning arresters, 28 static protectors and 200 ornamental street-lighting poles are among the items of equipment purchased during that period. C. Waldron, Jr., is assistant manager.

NEWFANE, N. Y.—The Newfane El. Co. and the Newfane Basket Co. have entered into an agreement whereby the latter will erect a power house on the site of its factory, recently burned, and the former will furnish machinery for it, lease the power house and water rights and furnish to the basket factory about one-fourth of the 300 hp to be developed.

NEW YORK, N. Y.—The Interborough Rapid Transit Co., of New York, N. Y., is asking for bids for three 30,000-kw turbo-generators for its Seventy-fourth Street power house.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until July 28 for additions and repairs to electric equipment at Public School 2, 116 Henry Street, and Public School 184, No. 31 West One Hundred and Sixteenth Street, borough of Manhattan; also for installing electric equipment in new Public School 102, on East One Hundred and Thirteenth Street, near Second Avenue, borough of Manhattan. Blank forms, plans and specifi-

cations may be obtained at the office of the superintendent, Park Avenue and Fifty-ninth Street.

NIAGARA FALLS, N. Y.—The lighting committee of the Business Men's Association has engaged H. B. Sweet, of Utica, N. Y., consulting engineer, to prepare plans for an electric-light and power plant to be built by the association.

OSWEGO, N. Y.—The People's Gas & El. Co., of Oswego, is reported to have closed a deal whereby it will secure electrical energy generated at the plant of the Salmon River Pwr. Co., now in course of construction at Stillwell in the town of Orwell. The contract calls for 2000 hp. The People's company has purchased a private right-of-way from the city limits to the plant, and will erect new transmission lines and install new machinery in the plant. The company will expend between $100,000 and $200,000 in this city and vicinity.

ROME, N. Y.—The Board of Public Works has awarded the contract for the ornamental street-lighting system to the Rome Gas, El. Lt. & Pwr. Co. The contract calls for 76 four-lamp clusters (100-watt tungsten lamps) at $56 each per year, and four five-lamp clusters (150-watt lamps), at $78.41 each per year. Albert B. Morton is local superintendent.

SYRACUSE, N. Y.—The contract for the permanent illumination of the State Fair grounds and buildings has been awarded to the Conduit El. Co., of Syracuse, at $17,089. The contract provides for the installation of 85 ornamental lamp standards along the principal thoroughfares.

FREELAND, PA.—The Lehigh Coal & Navigation Co.'s plant at Hauto will be connected with a transmission line to the Harwood El. Co.'s plant at Freeland. The completion of this work will insure Freeland against a breakdown if the Harwood plant should meet with an accident to its machinery.

HARWOOD, PA.—The Harwood El. Co., of Hazleton, has practically completed extension to its turbine room and the installation of a new 6250-kva General Electric turbine, Westinghouse Le Blanc condensers, extension to switchboard, etc. Contract has been awarded and work started on extension to boiler room. Order has been placed for five 650-hp Babcock & Wilcox boilers, equipped with improved Coxe automatic stokers. The Scofield Engineering Co., of Philadelphia, has charge of the engineering work. John S. Wise, Jr., is manager.

HAZLETON, PA.—The Harwood El. Co. is constructing an addition to substation supplying Hazleton and vicinity with electricity, increasing the output from 2000 to 5000 kw, alternating-current; also installing two 150-kw Westinghouse motor-generator sets; General Electric switchboard, lightning arresters, etc. The Scofield Engineering Co., of Philadelphia, is engineer. John S. Wise, Jr., is manager.

PORTVUE, PA.—Application has been made to the Borough Council by J. P. Wood (a southern promoter) for a franchise to establish an electric-light plant in Portvue. Mr. Wood has also applied for an electric-light franchise in Glassport.

RINGTOWN, PA.—The stream which furnishes water power to operate the plant of the Ringtown El. Lt., Ht. & Pwr. Co. will be converted into a reservoir to furnish water for domestic purposes, which will make it necessary for the company to install a steam or gas power plant within the next year. J. A. Yost is secretary.

FREEHOLD, N. J.—The Town Commissioners have awarded the Monmouth Lt. Co., of Freehold, a contract for street-lighting for the coming year. The contract provides for eight decorative arches to be erected over Main Street, each containing 15 25-watt tungsten lamps, at $120 each yer year, 12 four-lamp clusters, at $75 each per year; in the outlying districts 26 single 60-watt lamps, at $24 each per year, will be used.

JERSEY CITY, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 11 for pneumatic tube system in the United States post office in Jersey City, in accordance with specifications and drawings, copies of which may be obtained at the above office or of the custodian of post office in Jersey City, N. J. O. Wenderoth is supervising architect.

BALTIMORE, MD.—The Consol. Gas, El. Lt. & Pwr. Co., of Baltimore, it is reported, will extend its 11,000-volt transmission line to the villages of Granite and Woodstock. A number of quarries in that vicinity will be equipped for electrical operation.

HUNTINGTON, W. VA.—Application has been made to the Public Service Commission by the Tri-State Pwr. & Milling Co. for a permit to condemn land and build a dam on New River below Anderson Falls, in Summers County. The plans provide for the construction of a dam 80 ft. high, 98 ft. wide, with a wall 900 ft. long at crest to develop about 65,000 hp. O. L. Stearns, of Salem, Va., is president.

CHARLOTTESVILLE, VA.—The Charlottesville & Albermarle Ry. Co., of Charlottesville, expects to erect within the next two months a new power plant and has purchased the following equipment for same: Two 400-hp Babcock & Wilcox boilers, one 500-kw and one 1000-kw General Electric steam turbine, two Wheeler condensers, switching equipment for same, one General Electric rectifier and material for distribution system. John L. Livers is manager.

RICHMOND, VA.—Contracts, it is reported, will soon be awarded by the trustees of Richmond College for the erection of the power house, which will contain the central heating and electric plant of the new Richmond College at Westhampton.

WASHINGTON, D. C.—An American consular officer in the far east has been advised that a mining concern will shortly require a 2000 to 2500-kw electric power plant. For further information address No. 11,307, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

North Central

ALBION, MICH.—The Commonwealth Pwr. Co. has erected a temporary plant to take care of 2500 kw of load which was put into operation four days after the fire started. O. H Stecker is local manager.

DETROIT, MICH.—Bids will be received at the office of the Secretary of the Board of Education, 5 Broadway, Detroit, Mich., until Aug 12, for the erection, including general masonry work, general carpentry work, heating, plumbing and electric wiring, for a 16-room school building on Trombley and St. Aubin Avenues. Plans and specifications may be seen at the office of the supervisor of school buildings, Room 1, 5 Broadway. Charles A. Gadd is secretary.

EDMORE, MICH.—J. H. Gibbs & Son, proprietors of the local electric-light plant, expect to purchase a 45-hp steam engine directly connected to a three-wire direct-current generator to take the place of storage battery.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Pwr. Co. has leased the electric power system of the Muskegon Traction & Lt. Co. and will occupy the entire lighting and power field in Muskegon. The Muskegon company will continue to operate the gas and street-railway properties.

MACKINAC ISLAND, MICH.—The Municipal Wtr., Lt. & Pwr. Co., of Mackinac Island, expects to purchase within the next six months a 250-kw direct connected generating unit for lighting load. A. J. Doherty, Jr., is secretary and treasurer.

STANDISH, MICH.—The Michigan Cooperage Co., of Standish, has sold its electric plant to C. F. Hall, of Standish.

THREE RIVERS, MICH.—At an election held recently the proposition to issue $20,000 in bonds to establish a municipal lighting system and $30,000 in bonds to develop the city water power and to rebuild the pumping station was carried.

CLEVELAND, OHIO.—Bids will be received at the office of the secretary to the director of public service, No. 204 City Hall, Cleveland, until Aug. 5 for furnishing three-conductor paper-insulated cable for the municipal electric-light plant. Proposals must be made out on blanks furnished by the engineer of construction. W. J. Springborn is director of public service and W. H. Kirby secretary.

COLUMBUS, OHIO.—Bids will be received by the director of public service, City Hall, Columbus, until Aug. 5 for the erection of cluster lamps on the following streets: Fourth Street, from Mount to Livingston Street; High Street, from Warren Street to Fifth Avenue; State Street, from Fourth Street to Grant Avenue. Plans and specifications are on file in the office of the director of public service; proposal blanks may be obtained from the chief engineer. Samuel A. Kinnear is director of public service.

GREENWICH, OHIO.—Recent purchases of the municipal electric lighting plant include one 100-kva, 1100-volt, 60-cycle, three-phase Westinghouse generator; one panel for a commercial circuit and one for street lighting; 50 cedar poles, 20 lightning arresters, one 12-kw and one 5-kw transformer. Later it is expected to purchase a few smaller transformers. Wire and supplies will also be bought. F. H. Daniels is clerk.

LOWELLVILLE, OHIO.—Bids will be received by C. W. Baker, village clerk, until Aug. 1 for the purchase of $6,000 in bonds. The proceeds will be used for reconstructing electric-light lines, etc.

LOUISVILLE, KY.—Bids will be received at the office of the business director of the Board of Education, Administration Building, corner of Eighth and Chestnut Streets, Louisville, until Aug. 1, for electric wiring in George W. Morris and Eight-ward schools. Plans and specifications may be obtained on application to the above office. Samuel D. Jones is business director and J. Earl Henry is architect and engineer.

PADUCAH, KY.—The municipal electric-lighting plant expects to purchase within the next six months two 75-hp alternating-current motors directly connected to pumps for its sewage system. L. A. Washington, city engineer, has this matter in charge. J. O. Keebler is superintendent of the city lighting plant.

FORT WAYNE, IND.—The Fort Wayne & Northern Trac. Co. is planning to build a new power house and has already placed orders for two 6250-kva General Electric Curtis turbines complete with Worthington condensers and all switchboard apparatus. The company is changing its present 2200-volt, two-phase, four-wire system over to 4000 volts, three-phase, four-wire, and proposes to change all its motors from two-phase to three-phase and is making arrangements to install two-to-three-phase transformers in order to change the entire system over; the boilers are also being equipped with the new type of Roney stokers. The company has just connected up with the S. F. Bowser Oil Tank Co. and the Perrine-Armstrong Co. sawmills, furnishing the former with 375 hp and the latter with 265 hp. E. S. Myers is electrical engineer.

KOKOMO, IND.—The Indiana Rys. & Lt. Co., of Kokomo, has erected transmission lines to the towns of West Middleton, Russiaville, New London, Forest and Michigantown, for the purpose of furnishing

electricity for lamps and motors in the above-named towns. The company has also purchased considerable power-plant equipment, which will be installed this summer. Thomas C. McReynolds is secretary and treasurer.

PIERCETON, IND.—The Pierceton El. Lt. & Wtr. Co. expects to purchase within the next 20 days a new switchboard and circuit breaker. C. F. Shorb is superintendent.

CENTRALIA, ILL.—Extensive improvements have been completed by the Centralia Gas & El. Co. to its electric and gas plants, costing about $100,000. New equipment, including a 625-kva turbine generator, marble switchboard and two new boilers, has been installed. A new substation has also been erected in Sandoval. H. C. Higgins is owner of the plant.

MONMOUTH, ILL.—It is reported that Monmouth Commercial Club has secured funds to install an ornamental lighting system.

CAMBRIDGE, WIS.—Cambridge Lt. & Pwr. Co. has recently completed the erection of a new cement engine room. A new generator and oil engine were installed last month. H. C. Stair, secretary.

MARSHFIELD, WIS.—The managers of the municipal electric-light plant expect to purchase and erect within the next 90 days a new generating unit, consisting of a 500-hp cross-compound condensing engine directly connected to a 375-kva, 60-cycle, 220-volt generator, with switchboard panel for same. T. N. Young is superintendent.

MENOMONIE, WIS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 19 for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Menomonie. Drawings and specifications may be obtained from the custodian ot site at Menomonie or at the above office. O. Wenderoth is supervising architect.

MONROE, WIS.—The Monroe El. Co. expects to erect 1 1-3 miles of transmission line within the next 30 days. H. A. Smith is secretary.

PRAIRIE DU SAC, WIS.—William Albers, owner of the local electric-light plant, expects to rebuild about ¼ mile of the transmission line and will purchase about 30 meters and one test meter within the next 30 days.

DULUTH, MINN.—The Great Northern Pwr. Co., of Duluth, operating a hydroelectric plant at Thompson, which furnishes energy in the cities of Duluth and Superior, Wis., is reported to have authorized an increase in its capital stock from $2,500,000 to $11,000,000. The proceeds will be used to extend its transmission lines to a number of communities in northern Wisconsin and Minnesota.

ELLSWORTH, MINN.—Bids will be received by F. W. Stanton, village recorder, until July 31, for construction of an electric-lighting system for the village of Ellsworth according to plans and specifications which are on file in the office of the village recorder and also in the office of Earle D. Jackson, consulting engineer, Capital Bank Building, St. Paul, Minn. The work is divided into two parts as follows: (1) Consisting of cement block building; (2) furnishing and erecting oil engines, generators, storage battery, switchboard, pole line, etc. Separate bids will be received on parts 1 and 2. The sum of $2 (to cover cost of printing) must accompany application for copies of plans and specifications.

WADENA, MINN.—The Village Council has voted to purchase a new engine and generator to replace the two machines now in use. The new unit will have a rating of 200 hp and be directly connected. George S. Hughes is superintendent.

WORTHINGTON, MINN.—The city of Worthington is installing about 40 ornamental lamp standards and making short extensions to the municipal electric light and water systems. W. H. Buchanan, superintendent, has charge of the work.

BAYARD, IA.—At an election held July 8 the proposition to issue $6,000 in bonds for the construction of a municipal electric-light plant was carried. The Alamo Engine & Supply Co., of Omaha, Neb., has charge of the engineering work.

FOREST CITY, IA.—The Forest City El. Lt. & Pwr. Co. expects to erect within the next two months a new power house and to purchase one boiler, one 14-in. by 36-in. Corliss engine, one 100-kva revolving field generator, one two-panel switchboard with necessary instruments for alternating-current, pole insulators, transformers, lightning arresters, wire, etc.; also electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, wiring supplies, etc. Frank Kellogg is president.

GRUNDY CENTER, IA.—The Grundy Center El. Co. expects to purchase within the next six months one three-phase switchboard-type watt-hour meter with current transformer (150 kw) and about 20 steel poles from 30 ft. to 35 ft. long for the Main Street circuit, which is being rebuilt.

LAWLER, IA.—At an election held recently the proposition to issue $6,000 in bonds for the installation of an electric-light plant was carried.

OSKALOOSA, IA.—The Oskaloosa Lt. & Tract. Co., which was recently purchased by W. B. McKinley, is planning to erect within a few months a 60-ft. by 120-ft. carhouse, and to purchase the equipment for a 12-mile transmission line and one 350-hp boiler. H. W. Garner, secretary and manager.

STORY CITY, IA.—Within the next two months a new power house will be erected for the municipal electric-light plant and a new boiler, engine and generator will be installed, contracts for which have been awarded.

HAMILTON, MO.—The local electric-light plant, owned by the late Frank Clark, has been purchased by David Miller and H. L. Gilbert. The new owners, it is understood, will make extensive improvements to the property during the summer months.

JEFFERSON CITY, MO.—Bids will be received at the office of the State Capitol Commission Board, Jefferson City, until Aug. 14, for construction of power house and tunnel of the Missouri State Capitol, in accordance with drawings and specifications, copies of which may be obtained at the office of the commission or at the office of Tracy & Swartwout, architects, 244 Fifth Avenue, New York, N. Y. A deposit of $25 will be required for plans, which will be refunded upon return of same. J. Kelly Pool is secretary of board.

NECK, MO.—At a special election held recently the proposition to grant an electric-light franchise to a foreign company was carried. The company, it is said, will install a plant at a cost of about $25,000. A. M. Baird, of Cartersville, is attorney.

ELK POINT, S. D.—A. Smythe, city auditor, writes that the city is contemplating the installation of an electric-light plant, but as yet nothing definite has been done.

GRESHAM, NEB.—The proprietor of the local electric-light plant expects to install one Muncie 30-hp engine within the next two months.

CHANUTE, KAN.—The Commercial Club, it is reported, will consider the proposition of Carl Reynolds and associates who propose to construct a modern hydroelectric power plant and auxiliary steam plant near Austin, at the site of the old mill and dam. If the contract is secured it is proposed to organize a company and build a $100,000 plant. The plans provide for a 500-kw hydro-electric power plant and a steam generating plant of the same capacity. E. M. Stevens, of the E. M. Stevens & Co., of Kansas City, Mo., consulting engineers, has been engaged to prepare plans for proposed plant.

HUTCHINSON, KAN.—The city commission has adopted an ordinance authorizing the mayor and clerk to enter into a contract with the United Wtr., Gas & El. Co. for street-lighting for a period of ten years. The contract provides for the installation of an ornamental lighting system in the business district and for 40 additional arc lamps in the residence section.

TOPEKA, KAN.—The contract for extensions to the ornamental street-lighting system on several streets has been awarded to the Tucker Electrical Co., of Topeka, for $15,679. The contract provides for use of poles made by the Topeka Fdy. Co.

Southern States

TRYON, N. C.—The Tryon El. Lt. Co., it is said, will extend its transmission line to Landru, a distance of 3 miles.

CEDARTOWN, GA.—Bids will be received at the office of the supervising architect. Treasury Department, Washington, D. C., until Aug. 19 for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office building at Cedartown, Ga. Drawings and specifications may be obtained from the custodian of site at Cedartown, or from the above office. O. Wenderoth is supervising architect.

REYNOLDS, GA.—The City Council is contemplating the construction of a muncipal electric-light plant and would like to communicate with contractors and manufacturers of machinery for electrical plants. As yet nothing definite has been done or engineer engaged. G. L. Cooper is clerk and treasurer of the council.

ROME, GA.—The City Council has voted to enter into a contract with the Georgia Ry. & Lt. Co., of Atlanta, to furnish electricity for the new pumping station, the equipment to be installed within 90 days.

ROME, GA.—It is reported that arrangements are being made to transmit energy to Rome from the Tallulah Falls plant of the Georgia Ry. & Pwr. Co. Heretofore Rome has been furnished with energy from the plant of the Tennessee Pwr. Co., near Cleveland. The Georgia Ry. & Pwr. Co. has already erected a substation at Lindale, 5 miles from Rome, at a cost of $65,000, and arrangements are being made to complete the plant, which will cost about $200,000

JACKSONVILLE, FLA.—Posts have been ordered from the Union Foundry Co., Anniston, to be used in illuminating the business section, the energy for which will be supplied by the city lighting plant.

WINTER PARK, FLA.—The Council, it is stated, is contemplating issuing $10,000 in bonds for the installation of a municipal electric-light plant.

CENTERVILLE, TENN.—The Buckeye Spoke Co., Bon Aqua, Tenn., will petition the Mayor and Board of Aldermen for a franchise for an electric-lighting plant.

DICKSON, TENN.—Changes are being made in the engine of the municipal lighting plant which will effect a saving of 20 per cent. E. L. Payne, chairman.

ETOWAH, TENN.—The Etowah Wtr. & Lt. Co. is considering the question of establishing an ice factory next year. W. H. Price is manager.

MEMPHIS, TENN.—Bids will be received by the Mississippi River Commission, First and Second Districts, at the United States Engineer Office, Memphis, Tenn., until Aug. 21, for furnishing turbines, pump set, feed water heater and electric-light plant for hydraulic grader No. 1401. Further information may be secured on application to Major E. M. Markham.

SHELBYVILLE, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 28, for construction, including mechanical equipment, interior lighting fixtures and approaches of United States post office building at Shelbyville. Drawings and specifications may be obtained from the custodian at Shelbyville, or at the above office. O. Wenderoth is supervising architect.

CLAYTON, ALA.—The power plant of the municipal electric-light system was completely destroyed by fire recently.

GULFPORT, MISS.—The Yaryan Naval Stores Co., of Gulfport, it is reported, will make improvements to its plant, including replacing steam engines with steam turbines and directly connected generators, etc.

MENA, ARK.—W. B. Crossland, manager of the Newport El. Lt. & Pwr. Co., of Newport, is reported to have closed a deal with the City Council and has purchased the franchise for the electric-lighting plant here under the name of the De Soto Co-operative El. Lt. & Pwr. Co. Work, it is stated, will begin at once on construction of a new plant in Mena.

MELVILLE, LA.—The installation of a municipal electric-light plant is reported to be under consideration.

CLARKSVILLE, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 19, for construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches) of the United States post office at Clarksville, Tex. Drawings and specifications may be obtained from the custodian of site at Clarksville or from the above office. O. Wenderoth is supervising architect.

FREEPORT, TEX.—The Gulf, Freeport & Northern Ry. Co. has been organized, with principal office at Freeport, for the purpose of constructing and operating an interurban electric railway between Freeport and Sealy, about 100 miles. The proposed road will run through a number of towns, the more important ones being Brazoria and West Columbia. The company will construct a central power station at Freeport. The survey for the proposed road will soon be started.

GRANDVIEW, TEX.—The Texas Lt. & Pwr. Co., of Dallas has purchased the property of the Grandview Mill Lt. & Ice Co. and will take over the plant Nov. 1.

GREENVILLE, TEX.—The managers of the municipal electric-light plant expect to purchase a switchboard panel for the municipal electric-light plant to handle energy for Peniel, a nearby town, with integrating meter and circuit-breaker; also within the next month to purchase a constant-current arc regulator (50 lamps) in addition to one already installed which will split the arc circuits and call for 7000 ft. of No. 6 wire, and within the next two months to purchase five 5-kva transformers, one car of 30-ft. poles, 500 lb. of No. 8 wire and 48 5-amp meters. M. M. Arnold is alderman.

HOUSTON, TEX.—The city of Houston is reported to be contemplating the installation of a municipal electric-light plant. At first the plant will furnish electricity for municipal purposes only.

LONGVIEW, TEX.—The Longview Ice & Lt. Co. expects to erect within the next two months an annex to its engine room and has contracted for one 200-kva Fort Wayne generator and exciter, together with one 225-hp Diesel oil engine and auxiliaries. F. A. Matthes is manager.

MARBLE FALLS, TEX.—The city of Marble Falls is contemplating the installation of an electric-light plant and water works system.

MARSHALL, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 22, for construction complete, including mechanical equipment, mail lift, interior lighting fixtures and approaches of the United States post office at Marshall. Drawings and specifications may be obtained from the custodian of site at Marshall, or at the above office. O. Wenderoth is supervising architect.

Pacific States

ABERDEEN, WASH.—The fire and light committee of the City Council has recommended the construction of a municipal electric-light plant at the falls of the Wishkah River. For further information address the city clerk.

ASOTIN, WASH.—A telephone line from this city to Rogersburg, a distance of 24 miles, will probably be built before fall by A. H. Graves, owner of the local telephone system. Earls Ferry, Idaho, will be passed en route.

SPOKANE, WASH.—It is reported that an electric-light plant will be installed in the new building being erected by Patrick Welch at the corner of Main Avenue and Howard street for use of the Culbertson-Grote-Rankin Co. The plant will be located in the sub-basement where boilers for heating and power purposes and other machinery will be placed. The building will be equipped with five passenger elevators, two large freight elevators and two electric dumb waiters, a vacuum cleaning plant, air compressor, ventilating machinery, several pumps, etc. The Hurley, Mason Co., of Spokane, has the contract for construction of the building. Monroe K. Miller has supervision of the building for Mr. Welch.

SULTAN, WASH.—The Sultan El. Co. expects to purchase wire and all necessary material for a 4-mile 6600-volt transmission line. F. I. Anderson is secretary and treasurer.

VANCOUVER, WASH.—The Northwestern El. Co., it is reported, is contemplating the construction of a new substation at the corner of Albina and Railroad Street in Lower Albina.

BURNS, ORE.—The El. Lt. & Pwr. Co., of Burns, expect to install within the next two months one oil engine, generator and auxiliaries (about 75 kw) and to purchase within the next three months several distributing transformers and series tungsten lamps and within the next few months will purchase household labor-saving devices, including vacuum cleaners, washing machines, etc. The company will establish a day service (one day a week). Roy C. Dwyer is manager.

KLAMATH FALLS, ORE.—The sawmill and light plant at the Klamath Indian agency was destroyed by fire recently.

NEWBERG, ORE.—The Yamhill El. Co. expects to erect within the next two months a transmission line and distributing system at St. Paul, Ore., and to purchase within the next 30 days transformers, wire and material for same. C. J. Edwards is president and manager.

PORTLAND, ORE.—The contract for wiring the Northwestern Bank Building (15 stories high) has been awarded to the Pacific Fire Extinguisher Co., Railway Exchange Building, Portland, at $14,000. The Pacific Company, it is understood, will ask for bids for material in the near future.

BAKERSFIELD, CAL.—The San Joaquin Lt. & Pwr. Co. has been granted a permit to build an addition to its steam plant on the outskirts of Bakersfield, which will cost with additional machinery, $40,000. Improvements at the Kern River canyon plant, it is reported, call for the installation of a 5000-hp turbine engine.

LOS ANGELES, CAL.—The State Railroad Commission has granted the Southern California Edison Co., of Los Angeles, authority to issue $3,000,000 in capital stock, the proceeds to be used to pay existing indebtedness and for plant extensions.

LOS ANGELES, CAL.—The Department of Agriculture has issued a water power permit granting the Pacific Lt. & Pwr. Co., of Los Angeles, authority to operate power plants in the Sierra National Forest. The company will transmit energy 240 miles to Los Angeles at 150,000 volts. The permit allows 12 years for construction. Four power houses, two reservoirs and 25 miles of cement-lined tunnels will be built. Electricity will be transmitted over a double steel tower line of aluminum cables.

OAKLAND, CAL.—Plans are being prepared by George Babcock, city electrician, for the gradual installation of a municipal system of street lighting, by which the city shall own poles, lines and other equipment, and purchase energy from private corporations. The plan provides for installing the street-lighting system district by district, gradually spreading the municipal lines throughout the city.

SANTA BARBARA, CAL.—The Santa Barbara Gas & El. Co. has applied to the State Railroad Commission for authority to issue $100,000 in bonds for the purpose of extending and improving its system.

BUTTE, MONT.—Plans are being prepared by Paul Gow, city engineer, for the installation of 320 luminous arc-lamps in Butte. The cost of the work is estimated at about $32,525.

LOVELOCK, NEV.—Steven R. Young, of this city, is reported to have acquired the Lovelock Lt. & Pwr. Co. It is understood that the Southern Pacific Co. is arranging to purchase energy.

Canada

EDMONTON, ALTA.—The installation of a cluster-lamp lighting system on the principal streets of Edmonton at a cost of about $250,000 is contemplated. A. W. Ormsby is superintendent.

VICTORIA, B. C.—The Campbell River Pwr. Co., of Victoria, is reported to be preparing plans for the construction of a large hydro-electric power plant on Campbell River, in the northeastern portion of Vancouver Island. It is understood that it is proposed to develop 300,000 hp from the waters of the three falls of the river at a cost of about $12,000,000. George C. Hinton, of the Hinton Electrical Co., of Vancouver and Victoria, is one of the promoters of the project.

HALIFAX, N. S.—The Halifax Pwr. Co., it is reported, contemplates developing two sites on the Indian River, 18 miles west of Halifax. The upper station will be equipped with two units of 1200 kva each, one operating under a head of 90 ft. from the Indian River water shed and the other under a 160-ft. head from the North East water shed. About 5600 hp will be developed which will be transmitted to Halifax at 33,000 volts. C. H. & P. H. Mitchell, consulting engineers, of Toronto, have charge of the work.

PETERBOROUGH, ONT.—The Hydro-Electric Power Commission has been asked to set a price on the distribution system of the Peterborough Lt. & Pwr. Co. so that the local power committee may be in a position to know what price to offer for the equipment.

ST. THOMAS, ONT.—The Light, Heat & Power Department of the city of St. Thomas expects to erect within the next two months one auxiliary substation with an output of 450 kva for supplying energy to the St. Thomas Packing Co. and the Pere Marquette Ry. Co.; also to install within the next two months switchboard and equipment for new substation for which contract has been awarded to the Canadian General El. Co., and three 150-kva transformers, contract awarded to the Packard El. Co. The Michigan Central Ry. Co. is installing electrical equipment in its yards and shops at St. Thomas, and expects to use about 1000 hp, which will be furnished by the Light, Heat and Power Department of St. Thomas. E. H. Caughell is manager.

BATTLEFORD, SASK.—The managers of the municipal electric-light plant expect to purchase within the next three months two 250-hp engines with Westinghouse generators and switchboard, two 250-hp boilers to increase the output of the present plant; also to purchase within the next three months material for 6 miles of transmission line. F. K. Martin is manager.

New Incorporations

REEDSBURG, WIS.—The Reedsburg El. Co. has been incorporated with a capital stock of $10,000 by James R. Semple, James A. Stone and Anna L. Semple.

TORONTO, ONT., CAN.—The General Pwr. Corpn. has been incorporated with a capital stock of $5,000. The incorporators are: R. W. Hart, G. M. Miller and P. Stokes.

TORONTO, ONT., CAN.—The Kipawa Pwr. Co. has been incorporated with a capital stock of $100,000,000 by W. A. J. Case, J. B. Taylor and D. D. Fish.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 15, 1913.

[Prepared by Robert Starr Allyn, 15 Exchange Place, New York.]

1,067,246. WIRE-CLAMP FOR INSULATORS; J. H. Hubbard, Iron River, Mich. App. filed Dec. 6, 1911. Yieldable cam lever operates to clamp the wire to the insulator.

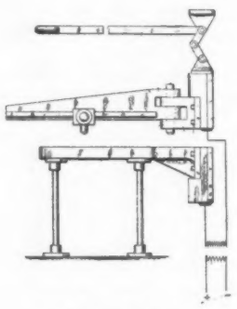
1,067,264. HOLDER FOR GLOWERS; R. Neckerman and O. Foell, Pittsburgh, Pa. App. filed Sept. 3, 1910. Pivoted supporting members are weighted so as to hold the glowers under proper tension and prevent them from sagging.

1,067,270. INDUCTION MOTOR; K. A. Pauly, Schenectady, N. Y. App. filed Mar. 31, 1911. Without changing connections, the rotor circuits are in inductive relation to the stator winding for both sets of poles.

1,067,274. TELEPHONE REGISTER AND LOCK OUT DEVICE; C. V. Richey, Washington, D. C. App. filed Nov. 6, 1912. Combined mechanical and electrical switching device adapted to bring about the transition from a lockout to a register system.

1,067,287. MAGNETIC SEPARATOR; G. Ullrich, Magdeburg, Germany. App. filed Jan. 12, 1912. Non-magnetizable rotatable carrying member shields the poles of the magnets.

1,067,311. WATTMETER; F. Conrad, Swissdale, Pa. App. filed June 21, 1912. Two potential coils mounted for movement about an axis located between them and two load coils adjacent opposite sides of the potential coils, each load coil opposite both potential coils.



1,067,478—Welding Machine.

1,067,325. ELECTRIC LOCOMOTIVE; G. M. Eaton, Wilkinsburg, Pa. App. filed Nov. 8, 1909. Yielding connection between the two articulated trucks.

1,067,331. FLUSH SWITCH MOUNTING; M. Guett, Hartford, Conn. App. filed Apr. 26, 1911. Switch receptacles removably secured transversely on a pair of longitudinally extending U-shaped supporting straps.

1,067,354. TRAIN TELEPHONE-CONNECTION POLE; W. Leach, Moose Jaw, Saskatchewan, Canada. App. filed Mar. 18, 1913. Pole carries a pair of sockets into which the two wire connecting members fit, controlling cords extending from the connecting members through the sockets and down along the pole.

1,067,407. SIGNALING DEVICE FOR LOCOMOTIVES; C. H. Cobb, Gt. Falls, Montana. App. filed Dec. 28, 1912. For signaling between the locomotive and the cars of the train.

1,067,437. NEGATIVE POLE PLATE FOR STORAGE BATTERIES; W. Morrison, Des Moines, Iowa. App. filed Sept. 7, 1912. Bond of active material electrochemically formed "in situ" from the grid interpenetrating and uniting the pasted active material and the grid.

1,067,452. ELECTRIC SWITCH OPERATING MECHANISM; O. N. Wiswell, Snoqualmie, Wash. App. filed July 12, 1911. Switch for three-wire line.

1,067,478. WELDING MACHINE; J. H. Gravell, Philadelphia, Pa. App. filed Oct. 31, 1912. Movable tool-carrying arm on one terminal and work-supporting member on other terminal extending beneath the tool-carrying arm.

1,067,481. SMELTING FURNACE; C. A. Kuenzel, Buena Vista, Colo. App. filed Aug. 17, 1912. Gas-fired furnace for smelting metallic ores.

1,067,482. LAMP SOCKET; C. D. Meeker, East Orange, N. J. App. filed Feb. 3, 1909. Pull socket construction with one-piece porcelain.

1,067,498. FUSE HOLDER; H. W. Young, Chicago, Ill. App. filed Jan 10, 1913. Fuse casing has a longitudinal opening in one side with a slidable cover plate to close same.

1,067,510. Trolley; J. Eberwein, North Tonawanda, N. Y. App. filed Dec. 28, 1912. Provides the trolley pole with auxiliary yieldable trolley wheels.

1,067,527. SIGNALING SYSTEM; C. A. Larson, Highland Park, Ill. App. filed Sept. 30, 1911. Selective signaling system for telephone exchanges.

1,067,561. TELEPHONE RECEIVER CASING; L. Swanson, New York, N. Y. App. filed May 25, 1910. Perforated metal strengthening body is embedded in the receiver casing.

1,067,562. ELECTRIC PUMP-GOVERNOR; W. V. Turner, Edgewood, Pa. App. filed May 28, 1907. Movement of the actuating piston to either the cut-in or cut-out position is rapid so as to gain a quick snap-like movement of the controlling device.

1,067,568. ELECTRICAL FUSE; H. W. Young, Chicago, N. Y. App. filed Dec. 14, 1912. Fuse member is shaped to pass through a zig-zag slot in the casing whereby the substitution of a fuse of different capacity is prevented.

1,067,573. END-CELL SWITCH; J. W. Achard, Philadelphia, Pa. App. filed Dec. 23, 1911. Movable brushes contact with contact rails and engage with different contact points when shifted.

1,067,580. ELECTRIC CONTROLLER; A. E. Berdon, La Fayette, Ind. App. filed Dec. 18, 1912. Combination of permanent magnet and pressure coil which is subjected to the pressure of the controlled circuit.

1,067,606. TELEPHONE SYSTEM; M. E. Grönvigh, Bergen, Norway. App. filed Apr. 15, 1913. Underground system of distribution for telephone cables.

1,067,620. COMMUTATOR BRUSH FOR ELECTRIC GENERATORS AND MOTORS; P. P. Nungesser, Cleveland, Ohio. App. filed May 19, 1911. A cap clamps a flattened plate enclosing the spread wires of the conductor to the carbon brush.

1,067,627. AUTOMATIC TEMPERATURE REGULATOR; B. F. Teal, Deceased, Glenside, Pa. App. filed July 22, 1910. Interdependent thermal controllers in the room and at the heater respectively.

1,067,629. TELEGRAPH DISPLAY SIGNAL; F. W. Wood, Newport News, Va. App. filed Feb. 11, 1909. Ship's telegraph system in which the signal received is repeated back to the sending station.

1,067,630. CAR-AXLE LIGHTING SYSTEM; J. L. Woodbridge, Philadelphia, Pa. App. filed Jan. 10, 1908. Maintains constant potential at the generator terminals through widely varying speed charges.

1,067,631. SYSTEM OF ELECTRICAL DISTRIBUTION; J. L. Woodbridge, Philadelphia, Pa. App. filed June 22, 1912. In which storage battery is employed to carry the load of an electric circuit when normal source of supply is interrupted.

1,067,647. ELECTRIC FLUID HEATER; W. H. Fox, Minneapolis, Minn. App. filed Aug. 8, 1912. Particularly for attachment to a radiator.

1,067,648. ELECTRIC CARTRIDGE FUSE; G. W. Frazier, Portland, Ore. App. filed Dec. 23, 1912. Fuse held at its ends by sectional tapered plugs fitting in correspondingly tapered sleeves.

1,067,685. METHOD OF MAKING BALL BEARINGS; J. Schmid-Roost, Oerlikon, Switzerland. App. filed Nov. 21, 1912. The two cage rings of the ball bearing are connected together by melting the projecting part of the thin connecting member which extends through the rings.

1,067,698. METHOD OF ELECTROLYTICALLY RECOVERING NICKEL; H. L. Wells, New Haven, Conn., and T. C. King, East Orange, N. J. App. filed June 22, 1907. Treats finely divided matter with hydrochloric acid, subjects solution to electric current, whereby nickel is plated out and chlorine gas evolved, and finally treats said gas with sulfureted hydrogen and absorbs produced acid gas in water.

1,067,702. TERMINAL LUG; H. J. Wiegand, Milwaukee, Wis. App. filed June 22, 1910. Sheet metal lug with body portion of double thickness, each layer having a lug clamping the conductor.

1,067,711. MULTIPLE SIGNAL TRANSMITTER; C. E. Beach, Binghamton, N. Y. App. filed June 3, 1911. Selective signal mechanism for fire alarm and district telegraph signaling.

1,067,715. TELEPHONY; S. G. Brown, London, England. App. filed Feb. 18, 1913. Telephone relay system for obtaining balance of electrical conditions in the two parts of the system on opposite sides of the relay.

1,067,718. TELEPHONE TRANSMITTER; J. Collins, Quaker City, Ohio. App. filed Oct. 21, 1912. Electrodes and resistance varying medium all carried by the diaphragm.

1,067,734. CROSSING SIGNAL; W. A. Hesse, Alameda, Cal. App. filed Nov. 1, 1912. Oscillating signal arm operated upon approach of train.

1,067,735. ELECTRIC SWITCH; E. M. Hewlett, Schenectady, N. Y. App. filed July 15, 1910. Oil-switch with arc-extinguishing device.

1,067,782. DYNAMO-ELECTRIC MACHINE; A. B. Field, Norwood, Ohio. App. filed Oct. 5, 1907. Rotor construction for alternators.